



# Market Intelligence on Improved Cook Stoves in Manyara and Arusha Regions



ICS Taskforce Tanzania  
October 2013

## About ICS Taskforce

Facilitated by SNV, the ICS Taskforce of Tanzania was created in 2011, with the Ministry of Energy and Minerals (MEM) as the Chair and the Tanzania Renewable Energy Association (TAREA) elected as the secretariat. The ICS Taskforce was initiated with the aim to increase coordination in the Improved Cook Stove (ICS) sector, for stakeholders to better understand and develop the sector through multi-stakeholder processes, while doing the necessary studies to come to a joint way forward for further ICS market development in the country. This document is one of the resulting documents of the ICS Taskforce. Other documents include: a technical assessment report of ICS in Tanzania, market intelligence studies for ICS in different regions of the country, ICS policy analysis, and a Country Action Plan for Clean Cookstoves and Fuels.

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## ABBREVIATIONS

CAMARTEC	Centre for Agricultural Mechanization and Rural Technology
CCT	Controlled Cooking Test
CO	Carbon Monoxide
COSTECH	Tanzanian Commission for Science and Technology
EU	European Union
GACC	Global Alliance for Clean Cook stoves
GCS	Global Cycle Solution
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GVEP	Global Village Energy Partnership
IAP	Indoor Air Pollution
ICS	Improved Cook Stove
KAKUTE	Kampuni ya Kusambaza Tekinolojia
KCJ	Kenyan Ceramic Jiko
LGA	Local Government Authority
LPG	Liquefied Petroleum Gas
MEM	Ministry of Energy and Minerals
MI	Market Intelligence
MSME	Micro, Small & Medium Enterprises
MVIWATA	Muungano wa Vikundi vya Wakulima Tanzania
NGO	Non-Governmental Organisation
POA	Program of Activities
ProBEC	Programme for Basic Energy and Conservation
REA	Rural Energy Agency
RETs	Renewable Energy Technologies
SACCO	Savings and Credit Cooperatives
SIDO	Small Industries Development Organisation
SME's	Small, Medium Enterprises
SNV	Netherlands Development Organisation
TAHA	Tanzania Horticultural Association
TAMPA	Tanzania Milk Processor Association
TAREA	Tanzania Renewable Energy Association
TaTEDO	Tanzania Traditional Energy Development and Environment Organisation
TB	Tuberculosis
TBS	Tanzania Bureau of Standards
TEMDO	Tanzania Machinery Design Organization
TFA	Tanganyika Farmers Association
TV	Television
TZS	Tanzanian Shillings
UNDP	United Nations Development Programme
WHO	World Health Organization

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Livinus Manyanga, Managing Director KAKUTE

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# 1. EXECUTIVE SUMMARY

An improved cooking stove is a stove that needs far less biomass to cook the same amount of food than a traditional one and consequently produces also far less smoke than a traditional stove. There is no international definition for the exact fuel savings which are necessary that a stove can be considered as an improved stove. However, it is usually admitted that an improved stove should save about 50% of the biomass in field test (different from laboratory ones) and/or reduce considerably the phenomenon of Indoor Air Pollution (IAP) due to bad combustion (production of smoke)

Lack of clear and reliable ICS market information and data is among key factors hindering wide scale and sizable commercialization and dissemination of ICS in Tanzania. In addition, such lack of information, adversely impact on effective coordination, financing, effective recognition by the government, and sizable private sector involvement in the subsector.

The objective of the assignment is therefore to establish market information on ICS and RE in general, including supply and demand sides data, supply chains, existing gaps and threats, strength and opportunities, consumer options and preferences, and propose areas for improvement including institutional, financial and value chain addition arrangements. The findings of Market Intelligence (MI) from these four district of Arusha and Manyara Regions together with that of other two regions and Lake Zone (already concluded), with the ICS policy assessment and technical status report, will finally be used as an input for a ICS sector development Programme PID planned for conclusion in November 2013.

This report has eight chapters including the executive summary, introduction and background, Objectives of the study, study methodologies, description of study scope, study findings, conclusions and recommendations.

**Arusha Region** is one of Tanzania's 30 administrative regions. Its capital and largest city is the city of Arusha. Administratively, Arusha region is divided into six districts which are: Arusha, Arumeru, Karatu, Longido, Monduli and Ngorongoro. Under local government setup, the region is divided into seven local authorities/councils: Arusha City and District Councils for Arusha, Karatu, Longido, Meru, Monduli and Ngorongoro. Arusha population is 1,694,310 people; the average number people per household is 4.5 and the number of household is 378,825 (as shown in the 2012 census); On the other hand Arusha is among the regions with fastest population growth rate which is 2.7 above the national average value of 2.7.

**Manyara Region** was formed from the former Arusha region in 2002. The formation of this new region was announced in the *Official Gazette* No. 367 on 27th July 2002. The Regional headquarters is located in Babati town which is 167 kilometres from Arusha, 157 kilometre from Singida and 248 kilometres from Dodoma. There are five administrative districts with six Local Government Authorities, namely: Babati Town, Babati, Hanang', Kiteto, Mbulu and Simanjiro District Councils, with 29 divisions, 123 wards, 393 villages and 1,540 hamlets. By the year 2011 the Regional GDP was Tshs 1,267,337 millions and per capita income was Tshs 879,014, which indicate that there are potential returns to investments. Manyara is among the regions with low population density of 28 people per sq. km, as well as the least urbanized regions in Tanzania. (As shown in the 2012 census) On the other hand Manyara is among the regions with fastest population growth rate which is 3.2 above the national average value of 2.7.

**Longido District Council** is one of the seven Councils of Arusha Region established on 1<sup>st</sup> July, 2007. The District is easily accessible from all the countries of East African Community. Administratively, the district is divided into three divisions which are Longido, Ketumbeine and Enduimet, 16 wards, 41 villages and 136 sub villages. Seven wards out of 16 and 9 villages are new formed in year 2010. It has a total of 21

councillors. The District has the population of 123,153 the house hold average size 5.0 and an area of 7,782 sq.km of which 6,392.35sq km is grazing land, 1,023.90 sq km is arable land, (of which 292.23 sq km is land under cultivation and 365.78 sq km is under forest reserve.

**Meru District Council** originated from the former Arumeru District Council and it was established on the 1<sup>st</sup> of July 2007 as the District Council with full Mandatory power. Meru district council covers an area of 1,268.2 square kilometres and about 13% of the total area (163.7 kms<sup>2</sup>) is covered by forest reserves. An area of about 813.5 kms<sup>2</sup> (64.1%) is used for agricultural activities, 37.05kms<sup>2</sup> (3%) for grazing, 15kms<sup>2</sup> (0.001%) for pasture/fodder, 203.7kms<sup>2</sup> (16%) for National Parks, 5.7kms<sup>2</sup> (0.4%) for water bodies and the remaining area of 44.39kms<sup>2</sup> (3.6%) of land is of settlement and unsuitable land. According to the 2002 population and housing census of 2012, Meru district council had a total population of 268,144 people. Out of which 131,264 (49%) are men and 136,880 (51%) are women. The estimated average household size is 5 members per household.

**Hanang' District Council** is one of the five district councils found in Manyara Region. It covers 3,639 Sq kms with population density of 78 people per sq km. The current population in 2012 is 275,990. The population density of the district by 2012 is 78 people per sq km while average household is estimated at 47,552. Population of the working age is estimated at 136,951 which is 48% of district population. The district is still underdeveloped and her inhabitants mainly practice an agriculture and pastoralist. The infrastructure is not well developed and many villages lack adequate social amenities. The average per capital income of the district is estimated to vary between USD \$150 to 200 per annum.

**Arusha District Council** is among seven district councils in Arusha region. The Arusha district council is divided into 3 divisions, 21 wards, 71 villages, 268 sub villages and 71,814 households. Arusha district council covers an area of 1446.692 sq kms based on the 2002 population and housing census data the council had a population of 290,041 being 140,336 males and 149,605 females with a population growth rate of 3.4%. The council is currently estimated to have a population of 328,996 being 141,560 males and 187,436 females with a population density of 227.4.

### **Energy Consumer demands**

The major energy supply for cooking and lighting in Arusha and Manyara regions comes from traditional biomass, mainly firewood and charcoal and kerosene. The high consumption of firewood, charcoal and kerosene is creating an imbalance in the supply and demand for household energy, which is accelerating deforestation and indoor air pollution, posing concerns for rural development and energy supply. Traditional stoves have a low combustion efficiency which results in longer cooking times and as such higher consumption of the firewood and air pollution which contribute to poverty and health problems.

The survey team visited Arusha and Manyara regions, 5 districts including; Meru DC, Arusha DC, Longido, Babati town council and Hanang district, 10 wards, 27 villages. 365 households were visited and interviewed to get information of their energy demand for cooking and lighting, the findings shows that 361 household (98.9%) out of 365 were able to respond on the energy source for cooking, and 327 (89.58%) respond to source of energy for lighting. To get information of their energy demand for cooking and lighting, the findings is that 355 household out of 361 (98.33%) depends on traditional source of energy for cooking and 214 (65.44%) out of 327 depends on kerosene and other traditional energy for lighting, only 25.76% respond to access and using RETs this include 13.42% solar lantern, 7.67% solar system for lighting, 2.46% ICS, 1.36% LPG and 0.27% biogas for cooking. 290 household 79.45% they are aware of solar, ICS and biogas. The limiting factors to access the technology were mentioned to be price 41.69%, awareness 27.67% and availability 24.35% and 6.27% could not give the reason.

The highest income for household per month is Tshs 757,242/= and the lowest income is 155,548 at an average of Tshs 456,395/=, the highest expenditure for energy per house hold is 61,912/= and the lowest is 14,968/= give an average of 38,440/=. The average expenditure for fuel is equal to 8.4% of the total average income. Fire wood cost a family an average of Tshs 2,000/= per day, charcoal 4,500/= and



kerosene 3,000/= LPG 1,800/=, for cooking. Kerosene cost Tshs 1,250/= an average per day, electricity Tshs 1,000/=, generator Tshs 2, 500/= torch of telephone & candle used at minimum cost for lighting.

Most institutions in Arusha and Manyara region are aware of ICS and use firewood as their primary cooking fuel. Improved institutional cook stoves are made by several entrepreneurs in Arusha and targeted schools, government institutions, food vendors and restaurants, but uptake has been low to food venter mainly due to lack of awareness and financial mechanisms to make them more affordable.

The rural segment mostly relies on collected solid fuels and has very low willingness to pay. Peri-urban respondents buy their fuel but have very low purchasing power. Problems with smoke are mentioned in terms of eyes itching, coughing and making utensils dirty. A cook stove program could consider opportunities for LPG for the better off.

Many people prefer using the technology if it is cheaper and available, when they were introduced to ICS, solar and biogas the most preferred technology was solar lantern 59% followed by ICS at the rate of 22% and biogas the last at 12%. The rest 7% could not respond to the question. An improved charcoal stove should clearly present considerable added value over the existing ones to be able to penetrate the market.

### **Energy Supply**

Different types of cook stoves were found to be used by community members in Manyara and Arusha district this include, three stone fire place, traditional charcoal stoves, improved charcoal stove, LPG and biogas for cooking and electric, solar system, solar lantern, kerosene lamp and lantern for lighting. Initiatives to promoting alternative fuels such as biomass pellets and briquettes exist in Arusha and Manyara region. Biomass pellets made from agro-waste such as rice husks and jatropha press are being trialed in Arusha and Manyara with complimentary clean cook stoves. There are also several manufacturers of biomass briquettes made from recycled char and other agri-waste such as charcoal dusts. Biogas program is promoted in Arusha and Manyara region focusing potential area with zero grazing diary keepers. Uptake so far has been limited to informal sector and restricted to commercial and industrial markets.

Entrepreneurs are interested to diversify to include RETs to their product for sale provided there is a demand from the market and reliable supplier of the product and financial loan mechanism to build their capital.

From observation many household are not accessing RETs in rural areas because they are not aware and for those who are aware they don't have much information about its advantages and do not know where to buy. There is no reliable supplier in these areas hence remain and depend on kerosene, fire wood and charcoal which is available at their vicinity

### **Energy Market Potential**

If we assume our sample is representative of the entire population of households in Arusha and Manyara regions 486,439. we can infer that the ICS and clean energy technology is a net positive investment for roughly 476,710 households (98%). Nevertheless, these estimates do not have much predictive power to an individual household within the population. Individual households are each unique; in order to understand the financial feasibility of the potential investment in an ICS, or any other renewable energy or energy efficiency projects for that matter, it is necessary to complete an individual household analysis for each situation which can be on the future plan. Assume this is the total market and 30% is potential market size. Within the observed range of monthly fuel expenditures there is considerable variability in estimates of financial feasibility. The standard deviation of monthly fuel expenditure, decreasing monthly fuel expenditure, decrease in IRR increase in time to payback, decrease in benefit cost ratio is also important thought.

Improved cook stoves are more available around urban centers particularly the central market of the districts in Arusha and Manyara regions. Increasing urbanization and rising charcoal prices is likely to push up demand for efficient stoves, in areas where people pay for fuel. Uptake of LPG is low due to the high upfront cost of the stove and gas cylinder and availability outside urban centers. Most of people at the

villages have informal (economy) way of getting their income so they don't know exactly amount of income making per month or per week.

### ***Lessons from other organizations***

The approach for market hub practiced by Mobisol and Rafiki market agent established by GSC whereby commission is paid to what they sale is very much appreciated and accepted by many entrepreneurs. Mobisol is one of the private firms providing a prepaid business model for solar home system to household direct. Many people have been attracted with this approach 1,000 solar system of different size 30W, 80W, 120W and 200W were accessed by the market in two years.

Imported stoves such as the Envirofit wood stove have also been introduced by L, Solution to the market but the number of distributors is low since it is a resource intensive activity. Other local manufacturers manufactured ceramic stoves from Same and Dar Es Salaam which have also been tested in the market, and distributed.

Biogas is promoted by CAMARTEC under the Tanzania Domestic Biogas Program with the aim to commercialize this technology through building capacity of biogas contractor enterprise (BCEs) for installation and providing after sales service.

Mobisol, Wodsta, GCS and OIKOS established the market hubs in the village to make sure the product is at proximity to the village where it is needed. The approach need to be encouraged and supported by village government leaders.

Embark energy provide training on business planning for clean energy entrepreneurs who wish to start the business or scaling up. They are also match making the entrepreneurs and impact investors once their business plan is complete and balance for investment.

### ***Potential supply chain***

A variety of stakeholders exist in the cook stove sector although experience and commitment in promoting improved cook stoves and other RETs may vary. A lot of stove production is done through informal businesses and artisans. Many producers will source out the making of liners and complete the cladding and assemble of the stove. Small artisans often work closely together at SIDO and CAMARTEC and TEMDO incubator program within their premises. Quality clay is available in Pare Mountain and Singisi in Meru and Karatu. Finished products are transported from commercial manufacture from Dar and Pare. The rest are imported stove from abroad including China.

Solar kits are imported from aboard by supplier existing in Dar and Arusha, there are several companies majoring in this sector based in Arusha. These include Mobisol, GCS, DLight, Rex Investment, M-Power, Tree, Iconic, Solar planet, Helvetic and Croride Exide.

Awareness need to villages based to household level which will make them aware on RET's. They suffer from IAP for those who are using 3 stones. Demand of solar lantern is high because they can afford it than solar home system due to the cost. There is several number of agricultural and rural penetrating companies which are dealing with agricultural input and buying the agric- products this includes TFA, TAMPA, TAHA, MVIWATA

## 2. INTRODUCTION AND BACKGROUND

### 2.1 Study problem

Lack of clear and reliable ICS market information and data is among key factors hindering wide scale and sizable commercialization and dissemination of ICS in Tanzania. In addition, such lack of information, adversely impact on effective coordination, financing, effective recognition by the government, and sizable private sector involvement in the subsector.

An improved cooking stove is a stove that needs far less biomass to cook the same amount of food than a traditional one and consequently produces also far less smoke than a traditional stove. There is no international definition for the exact fuel savings which are necessary that a stove can be considered as an improved stove. However, it is usually admitted that an improved stove should save about 50% of the biomass in field test (different from laboratory ones) and/or reduce considerably the phenomenon of Indoor Air Pollution due to bad combustion (production of smoke)

### 2.2 Study as the means for identified solution

In January 2011, SNV Tanzania supported a desk study on the household Improved Cook Stoves (ICS) sector in Tanzania, to get an in-depth understanding of the sector and its challenges. The results of the desk study were discussed in a multi-stakeholder workshop in Arusha on March 25<sup>th</sup> 2011. One of the key findings of the study is that *“Improved Cook Stoves (ICS), have been studied, promoted and commercialized in Tanzania since the 1980’s. However, despite many efforts by a wide variety of stakeholders, the actual use of ICS remains limited”*. This finding is further qualified by the UNDP’s report (2009) which indicates the ICS uptake to be merely 1% of all households; and estimates from TaTEDO are 10-20%.

The major challenges in the household ICS sector as researched by SNV are:-

- The sector is informally organized and lacks adequate communication, coordination and advocacy mechanisms on issues defined below.
- The sector has limited product diversity meeting consumer fuel use-cooking practice needs.
- The sector lacks economies of scale, which leads high cost of production and transaction and poor competitive advantage.
- The sector lacks sustainable working distribution models, with inadequate private sector development and participation; it is more being potentially limited in functionality and/or under-utilized in development efforts.
- Research and development is needed to assess the potential of a variety of appropriate ICS technologies and fuels/inputs.
- Lack of knowledge on user segmentation, needs, satisfactions, sensitization and experience with regard to ICS.
- Lack of knowledge on geographic areas (urban vs rural) and their characteristics with regard to ICS.
- Little evidence-based awareness on ICS benefits (health, monetary, efficiency, labour-time, gender).
- Lack of clear policies and strategies to support the ICS sub-sector.
- Insufficient business development skills and capacity among small entrepreneurs.

These challenges triggered key actors to form an ICS Task Force. The Task Force was formed in March 2011 and it consists members from the Rural Energy Agency (REA), Ministry of Natural Resources and Tourism (MNRT), Tanzania Renewable Energy Associations (TAREA), Tanzania Traditional Energy Development and Environment Organization (TaTEDO), SNV, Round Table Africa (RTA), Ministry of Energy and Minerals

(MEM), Tanzania Bureau of Standards (TBS), Tanzania Private Sector Foundation (TPSF), University of Dar es Salaam (UDSM), Sokoine University of Agriculture (SUA), Sustainable Energy Development Centre (SEDC) and the Commission for Science and Technology (COSTECH). In a Stakeholders meeting held in December 2012 at the College of Engineering and Technology, of the University of Dar es Salaam, Envotec was added to the list, as a representative of ICS makers. TAREA is the Secretariat of ICS Task Force.

The ICS Task Force intends to develop an impact oriented, private-sector led, commercially viable, and sustainable ICS sub-sector in Tanzania, and prioritized the following:-

- Phase 1: Coordination of the ICS sub-sector and stakeholders to better understand and develop the ICS sub-sector through multi-stakeholder processes and feasibility studies. Feasibility studies will include policy analysis, market intelligence and technology assessment.
- Phase 2: Based on Phase 1, develop the Programme Implementation Document (PID) to implement a national ICS programme.

### 3. OBJECTIVES OF THE STUDY

The objective of the assignment is to establish market information on ICS and RE in general, including supply and demand sides data, supply chains, existing gaps and threats, strength and opportunities, consumer options and preferences, and propose areas for improvement including institutional, financial and value chain addition arrangements. The findings of Market Intelligence (MI) from Arusha and Manyara regions together with that of other regions (already concluded) will, together with the ICS policy assessment and technical status report, finally be used as an input for ICS sector development Programme PID planned for conclusion in November 2013.

#### Specific Objectives

- To assess the biomass energy situation in the targeted area.
- To provide data on current cooking energy supply options: document the main energy products and services that are available in targeted regions particularly for both households and institutional cooking and lighting (firewood, charcoal, briquettes, pellets, sawdust, LPG, crop residues, husks, kerosene, dry cell torches, candles, car batteries, electricity, etc.).
- To identify evidence of the potential energy demand for ICS cooking, biogas and (solar) lighting products in target areas and currently people travel distances to access such products and or services.
- To estimate the number of micro-businesses per 1000 households within the target areas.
- To assess the extent to which micro-businesses already exist which are seeking to supply the market of ICS, cooking energy and lighting products.
- To assess the readiness of non-energy entrepreneurs in the target areas to engage in providing energy services such as ICS, biogas and (solar) lighting products distribution.
- To analyse the main challenges and drivers to adoption and scaling up of ICS and other RE technologies and key lessons learnt from existing experience.
- Describe the activities of other organizations that are operating within the household clean energy sector, which are of particular relevance to ICS subsector including main activities, approach taken and lessons learnt from their experience.
- To identify the bio mass cooking and lighting energy entrepreneurs in the study areas.
- Identify and quantify indoor air pollution data/ information from relevant institutions, actors and cook stove end users.
- To map agricultural companies and others penetrating in rural areas with extensive networks, as potential distributors of cooking and lighting technologies.
- To assess the market availability of products to consumer energy uses, etc.

## 4. APPROACH AND METHODOLOGY

### Desk Study in Dar es Salaam

Having signed the contract consultant prepare the inception report, methodology and tool for data collection which were reviewed in collaboration with SNV in Dar and agree with the scope of work. The main objective of the assignment is to establish market information on ICS and RETs in general, including supply and demand sides data, supply chains, existing gaps and threats, strength and opportunities, consumer options and preferences, and propose areas for improvement including institutional, financial and value chain addition arrangements. After the award of the contract the team carried out a detailed desk study. All the important literatures available in the web site and the government resource centre in Arusha Region were read to take note of important information about ICS and other related RETs in Tanzania and worldwide, population and social and economic data for the target Regions. A list of literatures and documents reviewed in the course of study is given in Annex 2.

### Preparation of Structured Questionnaires

The Consultant after reviewing the previous studies formulated tools for data collection, which constitutes four structured questionnaires for four types of target group including Government officials, ICS entrepreneurs, Institution and Household at community level. Having finished the literature reviews the designed questioners for field survey were done and reviewed by SNV ICS project manager; field area was identified and agreed by the government officials at regional level.

### Field Survey unit Data Processing

Trained and experienced assistants for the held survey work assisted the team. It is believed this will ensure quality standard of the data collected.

### Travelling to the Region Headquarter

*Sample Techniques and Sample Size:* Arusha and Manyara Regions were targeted regions for this study. Visits were made to these Regions to meet the Regional Administrative Secretary (RAS) to identify two potential districts within the region for survey. The consulting team joined RAS to identify potential district and introduce the TOR and scope of work. The team joined District Executive Director to identify two wards in each of the district and in each ward three villages were selected. At each village the team joined the village leader to selects twenty household, two institutions and two enterprises within their vicinity.

**Table 1: Sample size of the survey area Arusha and Manyara**

Sn	Region	District	Wards	Village	Household	Institution
1	Arusha RC	Arusha DC	2	6	60	12
		Meru DC	2	6	60	12
		Longido DC	2	6	60	12
	Manyara RC	Babati town	2	6	60	12
		Hanang District	2	6	60	12
	<b>2</b>	<b>5</b>	<b>10</b>	<b>30</b>	<b>300</b>	<b>60</b>

In total the target sample size were 2 regions, 5 districts elected, 10 wards, 30 villages, 300 house hold, and 60 institutions. The selection criterion was based on the supply and demand for renewable energy, diversity on income, urban and rural. In addition to that, the remoteness and inaccessibility of to commercial energy has made the local inhabitants more dependent on national forest for firewood. The availability of commercial is almost non-existent due to adverse topographic condition. Most of the populations of rural village are compelled to meet their energy needs through traditional energy resources like firewood and kerosene for lighting.

### **Study at district headquarters**

At the regional, district and ward levels, discussions were held to obtain background information on potential energy demand for ICS cooking, biogas and (solar) lighting products in their areas and distances people currently travel to access such products and or services. ICS and RE related micro-businesses survey: Visits were made to existing ICS and RETs micro business assessing the number, how they involved in energy businesses and particularly cooking and lighting energy. Interviews were made and data was collected from small kiosks, food vending and factories, to understand the challenges these businesses face and assessing the level of interest amongst non-energy micro- entrepreneurs in entering the market.

### **Survey in villages**

Consumer survey: In total 360 mixes of households and local traders such as street food vendors, small local shops were interviewed to understand how they could benefit from productive use of RETs. The current consumer source of energy for cooking and lighting were assessed, barriers and perception to uptake of energy products were assessed and the distance to such energy sources and the cost per unit volume or weight were observed. The assessment of energy demand, price and willingness to pay were carried out, the indoor air pollution awareness and incidences/ impacts reported/ unreported, known/ unknown were observed both at household level and government level.

### **Survey on agricultural and other rural penetrating companies with extensive networks**

We identify agricultural and other rural penetrating companies such as those contracting large number of farmers to assess their geographical coverage, outreach to farmers (numbers), how they organize their channels with farmers and assess their interest as potential distributors of solar/ICS in their geographical coverage.

### **Data compilation, analysis and report writing**

The report will therefore use both data available in a qualitative and quantitative way to arrive at findings and conclusions. The members of survey team themselves processed and tabulated data under the guidance and supervision of the team leader. At this stage, data analysis was done as suggested by MS Excel statistical data analysis to ensure adequate results. In addition to data and summary reports, consultant shared experiences and lessons from field in using different data collection techniques, questions and indicators. The team of consultants and research assistants consisted of the following members:

- (i) Mr. Livinus Manyanga, Team Leader/and renewable energy expert
- (ii) Mr. Goodluck Makundi
- (iii) Mrs. Lucy Morewa, Renewable energy market expert
- (iv) Ms Jacqueline Mushi. Data Analyst

As per the TOR of the Consultant, the draft report was submitted to SNV in view of receiving comments and suggestions, after incorporating the valid suggestions and comments.

### **Validation and verification workshop**

The consultant organized a data analysis meeting with the raw tables produced for each product identified if needed by clients. Such event brought the staff and partners to reflect on the data, develop explanatory assumption and identify need for further data for ICS programme. Based on this the consultant work to produce a draft report capitalizing on the analysis provided by the Arusha and Manyara region partners on the tables and produce if needed additional data in accordance with what the community has mentioned.

### **Findings documentation and Dissemination**

The survey was designed to characterize household energy portfolios in general with a specific focus on cooking fuels and energy for lighting. In our effort to generate information about the potential market demand for improved cook stoves we collected data regarding the factors that affect ability and desire to purchase an ICS. Data types collected were categorical, ordinal and continuous which includes, Site visits, interviews and consultations at Government level, literature review and secondary data collection from all

identified districts in the regions, detailed survey and administration of semi structured data collection tools including questionnaires for households, businesses, institutions, and entrepreneurs in four districts in Arusha and Manyara regions.

### **Limitation and challenge**

The study area was meant to be Arusha region only but Manyara was included and increased administrative cost and time.

- Many people at household were resistant in responding to our questionnaire mainly because they have been involved with different or similar research without seeing a significant impact from the result.
- ICS technology is part of natural resource management especially when asking about value chain on charcoal and wood, many people could not respond directly fearing that they might be held responsible for the answer they provide.
- ICS and RETs business are still dominated with informal sector which is uncoordinated, with no culture of keeping proper records.
- Many household do not keep record for their energy use and cost for energy, they use many sources of energy for cooking and lighting such that it becomes difficult to calculate exactly how much they spend in a specific source of energy per day or per month.
- We did not have brochure or sample product to show when asking their preference and willingness to buy. The responses to this question did not specify what kind and specific product brand they are responding to.
- Most of leaders complained about our visit which had no prior information. The notice was too short to them to organize people for interview. Most of the entrepreneurs could not give the income from their businesses because they do not keep records. Also others were reluctant to disclose their market strategy and their contact numbers. It was difficult to most the entrepreneurs to give the separate figures for sales of cook stoves, solar equipment as all items were mixed in their business.



## 5. DESCRIPTION OF STUDY REGIONS

### 5.1 Arusha Region



Arusha Region is one of Tanzania's 30 administrative regions. Its capital and largest city is the city of Arusha. The region is bordered by Kajiado County and Narok County in Kenya to the north, the Kilimanjaro Region to the east, the Manyara and Singida regions to the south, and the Mara and Simiyu regions to the west. Major towns include Monduli, Namanga, Longido, and Loliendo to the north, Mto wa Mbu and Karatu to the west, and Usa River to the east. Administratively, Arusha region is divided into six districts which are: Arusha, Arumeru Karatu, Longido, Monduli and Ngorongoro. Under local government setup, the region is divided into seven local authorities/councils: Arusha City and District Councils for Arusha, Karatu, Longido, Meru, Monduli and Ngorongoro.

**Figure 1: Map of Arusha Region**

Table 2: Population of Arusha Region by sex, average household size and sex ration					
Serial District council	Population Number			Average Household Size	Sex Ratio
	Total	Male	Female		
Monduli District Council	158,929.00	75,615.00	83,314.00	4.70	91.00
Meru District council	268,144.00	131,264.00	136,880.00	4.30	96.00
Arusha City council	416,442.00	199,524.00	216,918.00	4.00	92.00
Karatu District Council	230,166.00	117,769.00	112,397.00	5.10	105.00
Ngorongoro District Council	174,278.00	82,610.00	91,668.00	4.80	90.00
Arusha District council	323,198.00	154,301.00	168,897.00	4.50	91.00
Longido District council	123,153.00	60,199.00	62,954.00	5.00	96.00
<b>Total</b>	<b>1,694,310.00</b>	<b>21,282.00</b>	<b>873,028.00</b>	<b>4.5</b>	<b>94</b>

Arusha region with six districts was part of the former Arusha region which had ten districts. In July 2002 the former region was split into two regions namely; Manyara and Arusha. The regions total land surface areas consists of 33,570.8 sq.km of dry land and 955.2 sq km of water bodies giving total area of 34,526sq km.

#### 5.1.1 Population

According to 2012 national Population census, Arusha region had 1,694,310 people. This included 821,282 males and 873,028 females with average annual growth rate of 2.7 % and average household size of 4.5.

Arusha Regional Economy predominantly relies on agriculture and livestock rearing. Both commercial and small scale farming are carried out in the region. Other economic activities are manufacturing industries, tourism and mining (which are growing fast). The region has robust attractions in hospitality industries, International conference facilities, financial institutions and better communication and transportation networks. The estimate gross domestic product (GDP) for the year 2012 was Tanzanian shillings 2.1 trillion and per capital income was Tanzanian shillings 1,258,334.

### 5.1.2 Agriculture and Livestock sectors

Crops production contributes about 40 per cent of the regional gross domestic products (GDP) and employs over 80 per cent of its residents. Major crops grown include maize, wheat, millet, sorghum, legumes, coffee, banana cut-flowers, fruits and vegetables. The region has 467,380 hectares of arable land whereas only 210,000 (45% of arable land) hectares are under cultivation.

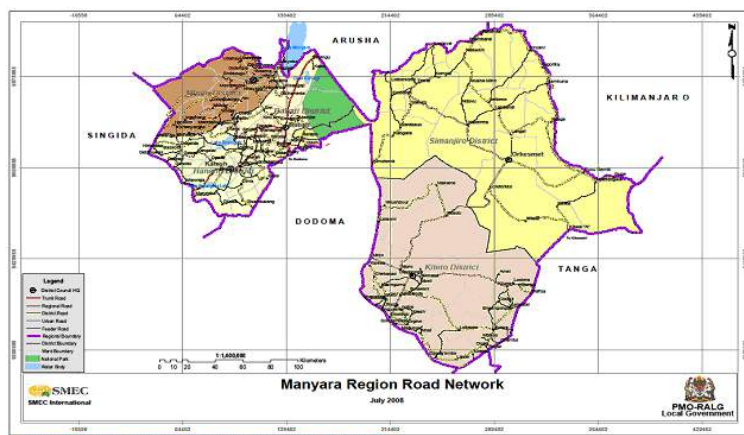
The region is also predominantly a livestock keeping area. Livestock keeping contributes about 20% of the regional GDP. Common livestock includes more than 1,840,987 cattle, 1,817,686 goat and 1,402,236 sheep. Sixty percents (60%) of land area is available for livestock grazing. Dairying is most suitable in Arumeru districts while beef production, piggery and ranching are also recommended for all districts.

### 5.1.3 Manufacturing Industry

There are 52 medium and large scale industries and 392 small scale industries. The manufacturing sector is based largely on agricultural products processing and more than two thirds of the sector uses locally grown farm produces. Commodities manufactured include processed food, beer, beverages, textiles, garments and shoes. Other commodities are electrical goods, soap, chemicals, pharmaceuticals, rubber and plastic products, metal and fabricated product.

## 5.2 Manyara Region

Manyara Region was formed from the former Arusha region in 2002. The formation of this new region was announced in the *Official Gazette* No. 367 on 27th July 2002. The Regional headquarters is located in Babati town which is 167 kilometers from Arusha, 157 kilometres from Singida and 248 kilometres from Dodoma.



There are five administrative districts with six Local Government Authorities, namely: Babati Town, Babati, Hanang, Kiteto, Mbulu and Simanjiro District Councils, with 29 Divisions, 123 Wards, 393 Villages and 1,540 Hamlets.

**Figure 2: Map of Manyara Region**

Manyara is among the regions with low population density of 28 people per sq. km. as well as the least urbanized regions in Tanzania. (As shown in the 2012 census). Such density is below the national average which is 49 but exceeds that of Lindi and Katavi which has 13 and 15 respectively. On the other hand Manyara is among the regions with fastest population growth rate which is 3.2 above the national average value of 2.7.

Manyara has good road transport network linking to neighboring regions. The water supply system is also adequately developed for domestic and industrial use. The region is also connected to the National electricity grid system which is continually being upgraded and expanded to meet the present and future power requirements. There is good number of modern communication and media companies operating in the region serving both local and international needs.

<b>Table 3: Population of Manyara Region by sex, average household size and sex ration</b>					
<b>Serial district/council</b>	<b>Population (number)</b>			<b>Average household</b>	<b>Sex</b>
	<b>Total</b>	<b>Male</b>	<b>Female</b>	<b>Size</b>	<b>Ratio</b>
Babati District council	313,392	158,804	153,588.	5.20	103.00
Hanang District council	275,990	140,212	135,778	5.70	103.00
Mbulu District council	320,279	161,548	158,731	6.00	102.00
Simanjiro District council	178,693.00	88,975.	89,718	4.60	99.00
Kiteto District council	244,669	120,233	124,436	4.80	97.00
Babati Town Council	93,108	47,313	45,795.00	4.40	103.00
<b>Total</b>	<b>1,425,131</b>	<b>717,085</b>	<b>708,046.</b>	<b>5.20</b>	<b>101.00</b>

### 5.2.1 GDP and Per Capita Income

In 2002 Manyara Region had a GDP of Tshs. 332,617 million and per capita income of Tshs 319,682. By the year 2011 the Regional GDP was Tshs 1,267,337 millions and per capita income was Tshs 879,014, which indicate that there are potential returns to investments. The trend in the growth of the GDP and per capital income in Manyara is an indication that investing in Manyara region will likely accrue positive returns.

### 5.2.2 Main Economic Activities

The main economic activities in Manyara Region are agricultural production, livestock keeping and mining. Agricultural production is dominated by peasant farming. The major food crops and cash crops that are cultivated by small farmers (peasants) includes maize, food beans, pigeon peas, sunflower, onions, garlic, coffee, paddy and finger millet. Maize, beans, pigeon peas, wheat and sunflower are the major contributors to the region's economy. However, commercial crop farming is practiced in a few places like wheat at Basuto in Hanang and pigeon pea in Babati and Hanang. Kiru Valley - the flood plain area between lakes Babati and Manyara, is the most fertile area in Manyara region. In this area, big farmers who own large estates grow various crops including sugar cane. This area has been a reliable source of crops since the colonial era and by mid 1930's it was occupied by re known millionaire settlers from Europe comprising Swedish barons, Russians, Americans and Germans.

Manyara region is rich in minerals that include tanzanite, ruby, green garnet, green tourmaline and rhodolite, tsavorite and tremolite. Majority of these precious stones are mined in Simanjiro district. Specific areas where are mined are: Mererani, Kaangala, Landanai, Komolo, Namalulu, lelatema hills and Naberera. Other places that are rich in minerals include for Chrysoberyl (Var: Alexandrite), Orgine village in Kiteto for red granite and moonstone. Recently, gold has been discovered in more than three areas in Mbulu district. The mining sector is an important contributor to the regional economy. The region has a large livestock population, which surprisingly has remained largely unexploited. There are roughly over 1.439 million cattle as well as 934,549 goats and over 373,399 sheep.

## 6. FINDINGS FROM FIELD SURVEY

### 6.1 Description of Survey Districts and Villages

#### 6.1.1 Longido District

Longido District Council is one of the seven Councils of Arusha Region established on 1st July, 2007. The District was formed after the splitting of the former Monduli District into two Districts (Monduli and Longido). Geographically, Longido District is located in the Northern part of Arusha Region. The District is easily accessible from all the countries of East African Community. Fortunately and naturally, One Stop Boarder of the East African Community is to be developed within one of the small towns of Longido District (Namanga One Stop Boarder).

Administratively, the District is divided into three divisions which are Longido, Ketumbeine and Enduimet, 16 Wards, 41 Villages and 136 sub villages. Seven wards out of 16 and 9 villages are new formed in year 2010. It has a total of 21 councillors. The District has an area of 7,782 sq.km of which 6,392.35sq. Km is grazing land, 1,023.90 sq. km is arable land, (of which 292.23 sq. km is land under cultivation and 365.78 sq. km is under forest reserve.

In the year 1988, population census results shows that Monduli/Longido recorded the lowest number of people than the remaining Districts. The total population in Longido District was estimated to be 96,172 in 2009 and 124,495 in year 2010. The main economic activities of Longido are Livestock keeping and wildlife. More than 90% of the population is engaged in Livestock keeping. Large scale farming is practiced in the north east part of the District; subsistence farming is the main form of farming. Livestock keeping is the main predominant economic activity it needs to be improved in order to contribute to the District economic growth.

#### GDP and Per Capital Income

Longido District has never computed its GDP and per capital GDP since it was established in 2007. Nevertheless, Longido District makes significant contribution to the Regional GDP and per capital GDP. The 2008 economic survey report shows that Arusha region's GDP was Tshs 1,145,878 million while per capital income of the residents was estimated at Tshs 756,878, (equivalent to U\$ 582).

#### Investment Opportunities in Industrial Sector

Longido District is a strategic area for industrial investment. The headquarters of the district is linked with the neighbouring country Kenya by a good tarmac road. The district is also endowed with abundant natural resources such as forests, wildlife and agriculture and livestock products which can be the main source of raw materials for large, medium and small scale industries. Industries which are favourably for investment are agribusiness; agro forests industries, milling machines, animal skin processing, poultry farms, furniture industries, tailoring, carpentry, tents and safari equipment, iron processing and soda ash industries. Wood and fuel are the major source of energy for domestic use. Namanga is served with electricity power. However, installation of electric power in Longido town is continuing.

#### 6.1.2 Meru District

Meru District Council originated from the former Arumeru District Council was established on the 1<sup>st</sup> of July 2007 as the District council with full Mandatory power. Meru district covers an area of 1,268.2 square kilometres and about 13% of the total area (163.7 kms<sup>2</sup>) is covered by forest reserves. An area of about 813.5 kms<sup>2</sup> (64.1%) is used for agricultural activities, 37.05kms<sup>2</sup> (3%) for grazing, 15kms<sup>2</sup> (0.001%) for

pasture/fodder, 203.7kms<sup>2</sup> (16%) for National Parks, 5.7kms<sup>2</sup> (0.4%) for water bodies and the remaining area of 44.39kms<sup>2</sup> (3.6%) of land is of settlement and unsuitable land.

Vision of the Meru District Council: To have a Community with improved and sustainable livelihood by the year 2025.

Mission statement: Meru District Council is committed to create conducive environment in order to provide quality socio-economic services to its community through effective and efficient use of resources and good governance for improved livelihood. According to the 2002 Population and Housing Census of 2012, Meru District Council had a total population of 268,144 people. Out of which 131,264 (49%) are men and 136,880 (51%) are women. The estimated average household size is 5 members per household.

### **6.1.3 Hanang' District**

Hanang' district is one of the five districts found in Manyara region. It covers 3,639 Sq kms with Population density of 78 people per Sq Km. The Vision of the District: "The Council aspires to be an institution of excellence in providing high quality and sustainable services by 2025". The Mission: "The Council will provide improved social-economic services through maximum utilization of the available resources".

The current population in 2011 is estimated at 285,314 People where 144,112 are male and 141,202 are female. The population density of the district by 2011 is 78 people per Sq km while average household is estimated at 47,552. Population of the working age is estimated at 136,951 which is 48% of district population. The district is still underdeveloped and her inhabitants mainly practice an agriculture and pastoralist. The infrastructure is not well developed and many villages lack adequate social amenities. The average per capital income of the district is estimated to vary between USD \$ 150 to 200 per annum.

#### **Economic activities**

Hanang' is a merging economy with high growth potential. Whilst the economy is relatively diversified, a number of opportunities remain untapped in many sectors. In an attempt to make Hanang the preferred destination for foreign and indigenous direct investment, continuous improvements towards the creation of an enabling environment have been made. Investment opportunities existing in Hanang have been categorized in terms of leading and priority sectors. These sectors are Agriculture, Livestock, Manufacturing and Trading, Health, Education, Natural Resources, Mining Sector, Tourism Sector, Banking and Economic Infrastructure

#### **Prosperity of investment and the main type and areas of investment opportunity**

The district is located at the centre in Northern eastern part of Tanzania whereby it is crossed with roads from central Tanzania. Goods produced in Hanang' district have access to reach outside easier. For instance, goods can reach Singida where a tarmac road is available to Mwanza and Dar es Salaam. Goods can also reach Arusha where is the tourist centre before accessing Kenya and Uganda.

The climatic condition in Hanang' enables the plantations of cash crops including wheat, barley, surf flower, sunflower, finger millet, pigeon peas and cow peas. All these produces have market in Arusha and far due to good infrastructures of the District in linking with other regions. The production and market of these crops can grow up as investment intensity increases due to the need. For that matter more investors are kindly invited to the district make maximum utilization of the available land.

### **6.1.4 Arusha District**

Arusha District Council is among seven District Councils in Arusha Region. Other Councils include Meru, Arusha Municipal, Monduli, Karatu, Ngorongoro and Longido. Arusha District council is divided into 3 divisions, 21 wards, 71 villages, 268 sub villages and 71814 households. Arusha District Council covers an area of 1446.692 sq kms based on the 2012 population and housing census data the council had a population of 290,041 being 140,336 males and 149,605 Females with a population growth rate of 3.4%. The council is currently estimated to have a population of 328,996 being 141,560 males and 187,436 females with a population density of 227.4.

The Council is bordered by Meru District Council to the East, Monduli District Council to the West, Longido District Council to the North West and Simanjiro District Council to the South. It surrounds Arusha Municipal Council in both sides. Arusha District council's ethnic groups are the Maasai, Waarusha being the dominant, Wameru, Wachagga, Wapare, Sukuma, Warangi are found in the trading centres that in-migrated from the nearest Districts.

The Arusha District Council residence main economic activities are agriculture livestock keeping and small scale enterprises. The council has 2 main agricultural zones including the green belt of the slopes of mount Meru to the South potential in banana, coffee and horticultural cultivation. The zone gets a rainfall of 800mm – 1000 annually. The other zone is in the lowlands belt potential in maize, beans, cassava, peas, rice, pigeon peas cultivation and livestock keeping practised on free ranch livestock keeping. The council experiences 2 rainy seasons long and short rains. Long rains begin on March to June while short rains begin in October to December. Livestock keeping on the green belt is practised in O grazing model (zero grazing approaches).

## **6.2 Findings from Consumer Demand Survey**

The major energy supply for cooking and lighting in Arusha and Manyara regions comes from traditional biomass, mainly firewood and charcoal and kerosene. The high consumption of firewood, Charcoal and kerosene is creating an imbalance in the supply and demand for household energy, which is accelerating deforestation and indoor air pollution, posing concerns for rural development and energy supply. Traditional stoves have a low combustion efficiency which results in longer cooking times and as such higher consumption of the firewood and air pollution which contribute to poverty and health problems.

The survey team visited Arusha and Manyara regions, 5 districts including; Meru DC, Arusha DC, Longido, Babati town council and Hanang district, 10 wards, 27 villages. 365 households were visited and interviewed to get information of their energy demand for cooking and lighting.

Most institutions in Arusha and Manyara region are aware of ICS and use firewood as their primary cooking fuel. Improved institutional cook stoves are made by several entrepreneurs in Arusha and targeted schools, government institutions, food vendors and restaurants, but uptake has been low to food vender mainly due to lack of awareness and financial mechanisms to make them more affordable.

The rural segment mostly relies on collected solid fuels and has very low willingness to pay. Peri-urban respondents buy their fuel but have very low purchasing power. Problems with smoke are mentioned in terms of eyes itching, coughing and making utensils dirty. A cook stove program could consider opportunities for LPG for the better off.

Many people prefer using the technology if it is cheaper and available, when they were introduced to ICS, Solar and Biogas the most preferred technology was solar lantern 59% followed by ICS at the rate of 22% and biogas the last at 12%. The rest 7% could not respond to the question. An improved charcoal stove should clearly present considerable added value over the existing ones to be able to penetrate the market.

### **6.2.1 Energy supply**

Different types of cook stoves were found to be used by community members in Manyara and Arusha district this include, three stone fire place, Traditional charcoal stoves, improved charcoal stove, LPG and Biogas for cooking and Electric, solar system, solar lantern, Kerosene lamp and lantern for lighting. Initiatives to promoting alternative fuels such as biomass pellets and briquettes exist in Arusha and Manyara region. Biomass pellets made from agro-waste such as rice husks and Jatropha press are being trialed in Arusha and Manyara with complimentary clean cook stoves. There are also several manufacturers of biomass briquettes made from recycled char and other agro-waste such as charcoal dusts. Biogas program is promoted in Arusha and Manyara region focusing potential area with zero grazing diary keepers. Uptake so far has been limited to informal sector and restricted to commercial and industrial markets.

Entrepreneurs are interested to diversify to include RETs to their product for sale provided there is a demand from the market and reliable supplier of the product and financial loan mechanism to build their capital.

From observation many household are not accessing RETs in rural areas because they are not aware and for those aware they don't have much information about its advantages and do not know where to buy. There is no reliable supplier in these areas hence remain and depend on kerosene, fire wood and charcoal which is available at their vicinity.

### **6.2.2 Energy market potential**

If we assume our sample is representative of the entire population of households in Arusha and Manyara regions, 486,439 we can infer that the ICS and clean energy technology is a net positive investment for roughly 476,710 households (98%). Nevertheless, these estimates do not have much predictive power to an individual household within the population. Individual households are unique; in order to understand the financial feasibility of the potential investment in an ICS, or any other renewable energy or energy efficiency projects for that matter, it is necessary to complete an individual household analysis for each situation which can be on the future plan. Assume this is the total market and 30% is potential market size. Within the observed range of monthly fuel expenditures there is considerable variability in estimates of financial feasibility. The standard deviation of monthly fuel expenditure, decreasing monthly fuel expenditure, decrease in IRR increase in time to payback, decrease in benefit cost ratio is also important thought.

Improved cook stoves are more available around urban centers particularly the central market of the districts in Arusha and Manyara regions. Increasing urbanization and rising charcoal prices is likely to push up demand for efficient stoves, in areas where people pay for fuel. Uptake of LPG is low due to the high upfront cost of the stove and gas cylinder and availability outside urban centers. Most of people at the villages have informal (economy) way of getting their income so they do not know the exact amount of income making per month or per week.

### **6.2.3 Lessons from other organizations**

The approach for market hub practices by Mobisol and Rafiki market agent established by GSC paid on commission of what they sale is very much appreciated and accepted by many entrepreneurs. Mobisol is one of the private firms providing a prepaid business model for solar home system to household direct. Many people have been attracted with this approach 1,000 solar system of different size 30W, 80W. 120W and 200W were accessed by the market in two years.

Imported stoves such as the Envirofit wood stove have also been introduced by L, Solution to the market but the number of distributors is low since it is a resource intensive activity. Other local manufactured ceramic stoves from Same and Dar Es Salaam have also been tested in the market, and distributed.

Biogas is promoted by CAMARTEC under the Tanzania Domestic Biogas Program supported by SNV with the aim to commercialize this technology through building capacity of biogas contractor enterprise (BCEs) for installation and providing after sales service.

Mobisol, Wodsta, GCS and OIKOS established the market hubs in the village to make sure the product is at proximity to the village where it is needed. The approach needs to be encouraged and supported by village government leaders.

Embark-Energy provides training on business planning for clean energy entrepreneurs who wish to start the business or scaling up. They are also match making the entrepreneurs and impact investors once their business plan is complete and balance for investment.

A variety of stakeholders exist in the cook stove sector although experience and commitment in promoting improved cook stoves and other RETs may vary. A lot of stove production is done through informal businesses and artisans. Many producers will source out the making of liners and complete the cladding and assemble of the stove. Small artisans often work closely together at SIDO and CAMARTEC and TEMDO

incubator program within their premises. Quality clay is available in Pare Mountain and Singisi in Meru and Karatu. Finished products are transported from commercial manufacture from Dar and Pare. The rest are imported stove from abroad including China.

Solar kits are imported from aboard by supplier existing in Dar and Arusha. There are several companies that are majoring in this sector based in Arusha. This includes Mobisol, GCS, DLight, Rex Investment, M-Power, Tree, Iconic, Solar planet, Helvetic and Chloride Exide, Illumination, Ls.Solution.

Awareness is needed to villages at household level to them aware on RET's. Those who are using 3 stones suffer from IAP. Demand of solar lantern is high because it is affordable than solar system at home due to the cost. There are several agricultural and rural penetrating companies that deal with agricultural input and buying the agric-products this includes TFA, TAMPA, TAHA and MVIWATA.

#### 6.2.4 Micro-business survey

In this topic consultant identify number of potential micro-enterprises which are potential providers of energy services and technologies. The table No3 below shows some of potential supplier and distributor of ICS and RETs technology for lighting in Manyara and Arusha region. There is no formal coordination of ICS and solar distribution activities in Arusha and Manyara region only biogas which is underway by TDBP under CAMARTEC. The incubator program under SIDO, TEMDO, and CARMATEC support ICS entrepreneurs to get formalized and running but result is yet to be realized. Individual initiatives by private sectors have been the major drivers of the uptake of technologies in the regions.

**Table 4: Existence of micro-businesses already providing electricity based services which do not use grid power for Arusha and Manyara region.**

SN	Micro business	Location	Service provided	Product
1	Mobisol UK Ltd	ARUSHA	Prepaid system through marketing hub established in Arusha, Kilimanjaro and Manyara.	Mobisol solar system
2	Global cycle Solution	ARUSHA	Distribution of solar lantern to different market in Arusha, Manyara and Kilimanjaro.	Solar Portable Lights (SPL)
3	PY ENGINEERING Ltd	ARUSHA	Manufacturing and promotion of PY Cook stove in Arusha Kilimanjaro Manyara Morogoro and Dar.	CHASS – Cook stove
4	TREE Ltd	ARUSHA	Distribution of solar kits and ICS JIKO Bomba and Pallets to different market in Arusha Kilimanjaro.	Solar Kits Breefoot, Jiko bomba and Moto bomba
5	DLIGHT/ Benson	ARUSHA	Distribution and marketing of the DLight products in Arusha Kilimanjaro and Manyara	Solar Portable Lights (SPL)
6	Kiwia and Laustsen	ARUSHA	Distribution of solar kits, ICS and Pallets to different market in Arusha Kilimanjaro.	Solar lantern cook stove and Pellet
7	Estec		Production and installation of community cook stoves	Institutional cook stove
8	M-Power	ARUSHA	Provides off grid energy services on monthly services	Solar kits
9	Power provider	ARUSHA	Provide off grid solutions	Solar kits
10	Shaffi K. Msuya	Arusha	Stove whole seller at the central market	ICS and TCS
11	Makoga Shukrani	Arusha	Stove retailer and whole seller in Central Market	ICS of different size and TCS
12	EAST AFRICA BRIQUATE CO	ARUSHA	Production and distributor of efficient community cook stoves	Briquette
13	KAIHURA	ARUSHA	Production and installation of community cook stoves	Institutional cook stove
14	Helvetic	ARUSHA	Provide solar design supply of equipment and installation	Solar system and equipment such as



				solar heaters
15	L-Solution	ARUSHA	Provide solar equipment and imported cook stove	Wooden stove and solar equipment
16	Ndekirwa Kitomari	ARUSHA	Making of cook stove liner	Cook stove liner
17	Kimario	Arusha	Designer and producer of different types of ICS at SIDO premises	ICS of different design
18	Green Energy Solution	Arusha	Produce bio-charcoal for commercial market	Biocharcoal
19	Illumination	Arusha	Distribution and marketing of the Solar lantern products in Arusha Kilimanjaro and Manyara	Solar Portable Lights (SPL)

Table No 4 explain different types and size of ICS and energy source for lighting disseminated and used for domestic and commercial operation. It caters for 3 types of stoves: (a) metal stoves, (b) ceramic stoves and (c) large stoves for institutions; solar lantern of different size and solar system are available in Arusha and district towns.

**Technical barriers:** A number of different technologies for improved cook stoves is available such as ICS wood stove, ICS charcoal stove, ICS pellet stove, ICS briquette stove, Sawdust stove and LPG stoves. The barriers related to technology include lack of skills on the construction and maintenance of the improved cook stoves and promoting technologies that are not easily disposable for local communities and require importing expensive components. Solar systems and lantern have no effective guarantee.

### 6.2.5 Level of interest for entrepreneurs in providing energy services

Most of the above micro enterprises are located in major town of Arusha and Babati, their distribution centres are located in district. Consultant focus more on hardware shops at the district town and retail shops at village level. From the sample of 42 entrepreneurs within the survey area 22(53%) were retail shop in the village towns and 20 (47%) were hardware shops within district town. The cook stoves are mostly done by local artisan within the area but they are not commercial product within the village.

60% of the shop owners showed interest in getting a sample of solar lantern product for market but they needed to know more about the products information and the price structure, while for hardware they are ready to stock the product but this depends on the market drive. RETs especially solar system requires technical knowhow to support installation training of technician might influence more hardware shops to stock the products. Shop owners could not see ICS as commercial commodity. The price for improved cook stove is limiting factor for commodity to sale within their shops. The following table shows the entrepreneurs who are working on business plan for investment to promote RETs within Arusha and Manyara.

**Table 5: List of entrepreneurs interested to provide RETs services**

NAME OF THE ENTERPRISE	SERVICE	MARKET TARGET AREA
Green Energy Solution ( GREENS) P.O. Box 11555, Arusha Email : kkoshuma@yahoo.com Cell Phone : 0754373609	Briquettes and Improved cook stoves (Green jiko)	Arusha Town Eg Restaurants, Super market, shoprite, hotels and Households.
Kaihura General Supplies (KGS) P .O. Box 8048 Arusha. Email:kaihurageneralsupplies@yahoo.com Cell 0754271051	Institutional cook stoves and briquettes business on progress	Arusha, DSM, Mwanza
Vision for Youth (V4Y) Bright Energy East Africa P. O. Box 8323, Arusha Email :info@v4y.org Cell: 0762 580 508/0767 997 418	Charcoal briquettes	Arusha

Illumination East Africa (IEA ) P.O. Box 23326, Undali Street, Upanga Dar es salaam Email: edith_mshinwa@yahoo.com Cell: 0754 426 389.	Solar lanterns	Arusha, Manyara, Tanga, Mwanza
Light up your life organization (LYLO) Email: happy5464@yahoo.com Cell: 0762 419 462	Solar home systems and solar lanterns	Arusha (Arumeru and Arusha town)
Jitihada Support Limited (JSL) P.O. Box 12050 Email: jitihada.tanzania@ymail.com Cell: 0754 574 073/ 0784 574073.	Solar home system, and Micro credit	Arusha, Manyara,
KAKUTE Project Company Limited,(KPCL) P .O. Box 13954, Arusha Email:lucyelmos@yahoo.com Cell: 0768 101 023	LP Gas and Solar home system	Arusha urban and rural
Initiative for promotion of renewable energy (IPRE) P. O. Box 10260 Email : ngomu.wilbard@yahoo.com Cell: 0763 283 429	Cook stoves and briquettes	Arusha urban
Arusha TanLight investment company limited P.O .Box 11894, Arusha Email : csamzugi@gmail.com Cell : 0767 460 852	Solar home systems	Arusha, Manyara, Tanga
Environmental serving technology centre (ESTEC) P. O. Box 10282-Arusha Email: franklamtane@gmail.com Cell : 0769 606 002	Institutional cook stoves	Arusha, Kilimanjaro, DSM.
Longsales Services EA Limited P.O. Box 12677-Arusha Email: longsales.ar@gmail.com Cell : 0756 394 038	Solar equipment	Arusha, Manyara.

### 6.2.6 Method for establishing cooking technologies and services options

In Arusha and Manyara Regions there are 10 districts and 237 wards. The house holds for Arusha and Manyara are 286,579 and 199,860 respectively. The total number of household in Manyara and Arusha regions is 486,439. From the sample; result shows that 98% depends on biomass source of energy for cooking. The potential for ICS is high assuming that 50% of the household in Manyara and Arusha region are yet to access the RETs that mean we need to reach 243,221 household in Manyara and Arusha regions.

Stove marketing programs can benefit from employing these methods in two distinct ways. Through the lens of the case study of the ICS in Arusha and Manyara, I demonstrated both of the methods. The first method is to conduct a random household survey in the region of interest that allows the marketing program to estimate the financial feasibility of the investment for a representative sample of the population. If the analysis and survey are conducted properly, this will result in an estimated total number of households that can theoretically benefit financially from the purchase of an ICS. In the case of the ICS and solar for lighting in Arusha and Manyara, this resulted in an estimate of roughly 486,439 households for which the investment in the product is estimated to be net positive.

**Information barriers:** Lack of awareness of the local communities on the economic, environmental and health benefits of improved cook stoves. The mechanisms that define access to ICS are numerous, and have

some overlap with the factors that affect technology and fuel switching and stacking. All of the following mechanisms and/or conditions must be in proper alignment with the local condition and situation of each household seeking access to an ICS:-

1. Purchasing power and availability of credit.
2. Willingness/ability to pay.
3. Availability of products near the home.
4. Accessibility of appropriate fuel types.
5. Knowledge and understanding of potential health and financial benefits.
6. Cultural appropriateness of the technology.
7. Intra-household social relations and their influence on decision.

### **6.2.7 Meeting with community leaders**

Consultant met with community and discussed the energy needs and their views on cooking energy products and service. The community leaders met include Ward Executive Officer (WEO) at ward level and village chair within the village level.

- Most of the community rely on biomass source of energy for cooking this include fire wood in very remote area, firewood and charcoal in village town and charcoal combine with kerosene within town. LPG and biogas are yet to be commercially distributed. The available technology for cooking is dominated by three stone fireplaces in the village area and traditional metal charcoal stove combine with kerosene stove dominate in town. ICS is partly used for few household and awareness is yet to be done aggressively to create demand and distribution of such technology is not yet done within the village where it is mostly needed to reduce the pressure on forest.
- Traditional charcoal stoves, improved charcoal stove, LPG and Biogas, Electric, solar system, solar lantern, Kerosene lamp and lantern are the most used technology for lighting. Initiatives promoting alternative fuels such as biomass pellets and briquettes exist in Arusha and Manyara region. Most of the community leaders are not aware of biomass pellets made from agro-waste such as rice husks and Jatropha press are being tested in Arusha and Manyara with complimentary clean cook stoves. There are also several manufacturers of biomass briquettes made from recycled char and other agro-waste such as charcoal dusts. Biogas program promoted in Arusha and Manyara region focusing potential area with zero grazing diary keepers.
- Most of village have polices to protect the environment for example every family to plant trees per year, the problem they don't have alternative to support the policy. All village visited are reachable though during rainy season might be difficult to access. In some areas for example Ngarenanyuki they have ANAPA and OIKOS who provide training on how to conserve environment as well uses of ICS.
- In rural areas availability of electricity, biomass source of energy kerosene is limited this expressly in Longido some of the villagers need to walk a distance depending on the location of shops. Inhabitant of some villagers has to walk long distances to find firewood. In urban areas they get firewood and charcoal from a supplier who brings it to town. It is not clear who specifically supplies the charcoal and fire wood because it is not formal business.

### **6.2.8 Stakeholders interviews**

Consultant directly interview actors and stakeholders in enabling environment including Local Government Authority, Civil Society, NGOs and parastatal organizations to gain deeper understanding of challenges and successes in past, present and future on clean cooking and lighting programs that are ongoing in the district. Consultant discussed with local micro-finance institutions (SACCOS, etc) to identify potential MFIs who would deems ICS (or RE in general) as worthy of consumer or enterprise credit provision.

- Despite recognition that ICS and RETs for lighting are important sources of energy for Arusha and Manyara region for households and institutions, these technologies have not attracted neither the requisite level of investment nor tangible policy commitment. Although regional, national and international resources allocated to promote developing, adapting and disseminating RETs in many years may appear substantial; the total amount is still insignificant compared to that allocated to the conventional energy sector.

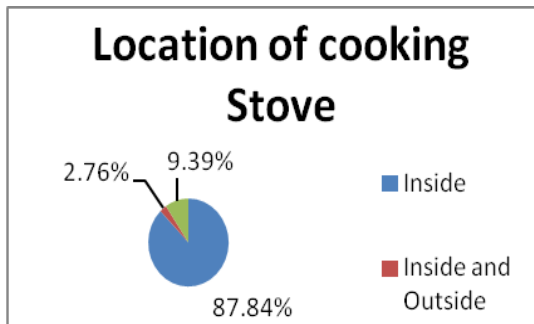
- It is observed that the success of RETs in Arusha and Manyara regions has been limited by a combination of factors which include: poor institutional framework and infrastructure; inadequate RET planning policies; lack of co-ordination and linkage in RETs programmes; pricing distortions which have placed renewable energy at a disadvantage; high initial capital costs; weak dissemination strategies; lack of skilled manpower; poor baseline information; and weak maintenance service and infrastructure.

It was suggested to develop a national program for ICS and RETs which address the challenge mentioned above and design the strategy for intervention for a short-term and long term. The development should involve stake holders at all level on the supply chain.

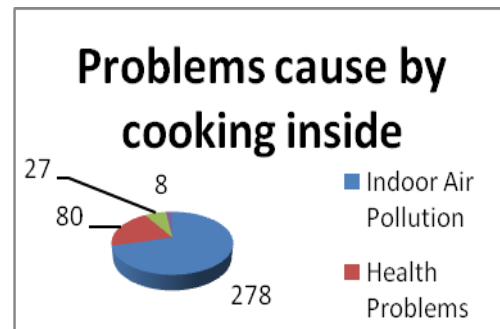
### 6.2.9 Number and impacts of reported and unreported IAP incidences

The use of biomass with traditional cooking devices combined with unsuitable cooking spaces is the main cause of IAP in Arusha and Manyara region. Open wood fires and traditional cook stoves at both the residential and institutional level are the primary cause of indoor air pollution in rural homes. Traditional charcoal stoves burning poor quality charcoal cause exposure to carbon monoxide. Low grade biomass and agricultural residue used as cooking fuel increases the exposure to IAP.

**Figure 3: Location of cooking**

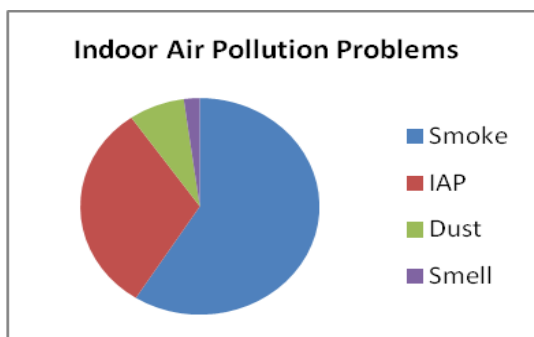


**Figure 4: Problems caused by cooking inside**

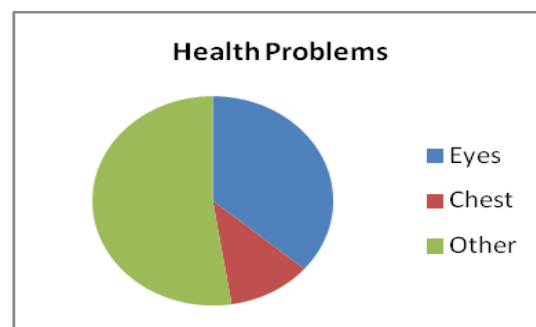


Problems with smoke are mentioned in terms of eyes itching, coughing and making utensils dirty

**Figure 5: Indoor Air Pollution**



**Figure 6: Health problems**



When asked to specify how air pollution bothered them, most named "eye irritation" (28%) as being the primary consequence from the smoke. Many elected not to cite a specific problem that was caused by the IAP from their stove (14%), while some merely stated that it bothered them because it is bad for general health (6%). A small percentage of the population reported that there is IAP from their stove but that it does not bother them in any way (5%).

## 6.3 Consumer Demand Survey

In order to estimate the demand forecasts for the project, consultant undertakes consumer demand survey. Interviews were made to 365 consumers including a mix of household, institutions and of local traders that could benefit from improved cooking and lighting energy services such as street food vendors, "Nyama Choma" roasters, chips kiosks, restaurants etc.

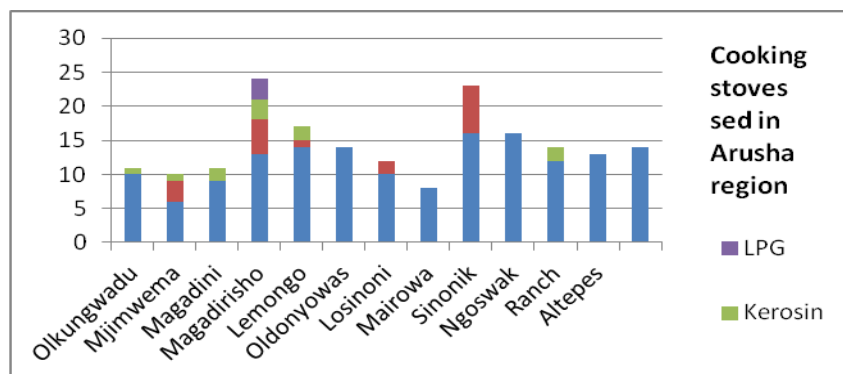
### 6.3.1 Household survey

The total 365 household were targeted to be interviewed; table below shows that 361 (98.9%) out of 365 were able to respond to the current energy source for cooking, and 327 (89.58%) households were interviewed and respond to source of energy for lighting. Majority of people in Arusha and Manyara region live in rural villages which are so scattered. Average population density in Arusha region is 45 people per square kilometre and 32 in Manyara region.

**Table 6: Source of energy for cooking and lighting**

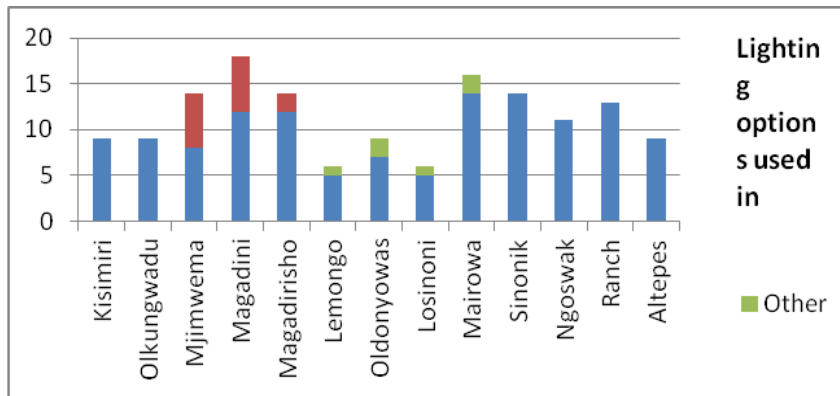
Source of energy for Cooking			Source of energy for lighting		
Type	Urban	Rural	Type	Urban	Rural
Fire wood	42	242	Kerosene	37	168
Charcoal	21	31	Electric	29	9
Kerosene	10	9	Solar	7	67
Biogas	1	-	Candle	-	2
LPG	1	4	Generator	-	3
			Torch	-	5
<b>Total</b>	<b>75</b>	<b>286</b>		<b>73</b>	<b>254</b>

The findings from **table No 6** shows that 355 households out of 361 (98.33%) depend on traditional source of energy for cooking and 214 (65.44%) household out of 327 depends on kerosene and other traditional energy for lighting. Only 25.76% access and using RETs this include 13.42% solar lantern, 7.67% solar system for lighting, 2.46% ICS, 1.36% LPG and 0.27% biogas for cooking. 290 people 79.45% they are aware of Solar, ICS and biogas. The limiting factor to access the technology were mention to be price 41.69%, awareness 27.67% and availability 24.35% and 6.27% could not give the reason.



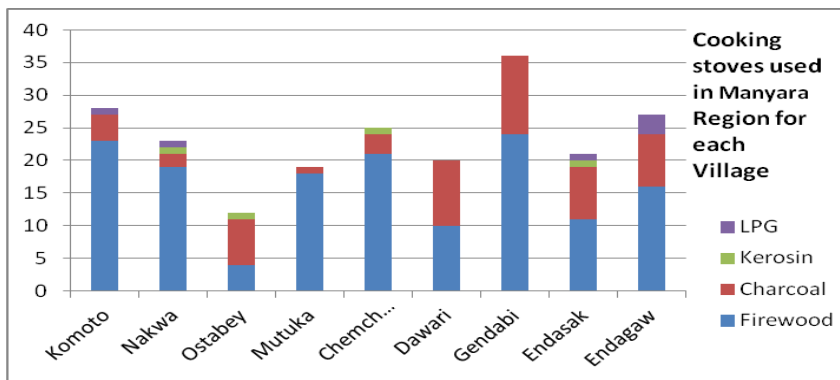
**Figure 7: Current cooking energy used by village in Arusha**

**The figure No 7** shows that In Arusha three distinct 12 village were visited and current energy used for cooking at each village is shown from the above table. Fire wood is leading followed by Kerosin and charcoal. The least is LPG.



**Figure 8: Current energy used for lighting by village in Arusha**

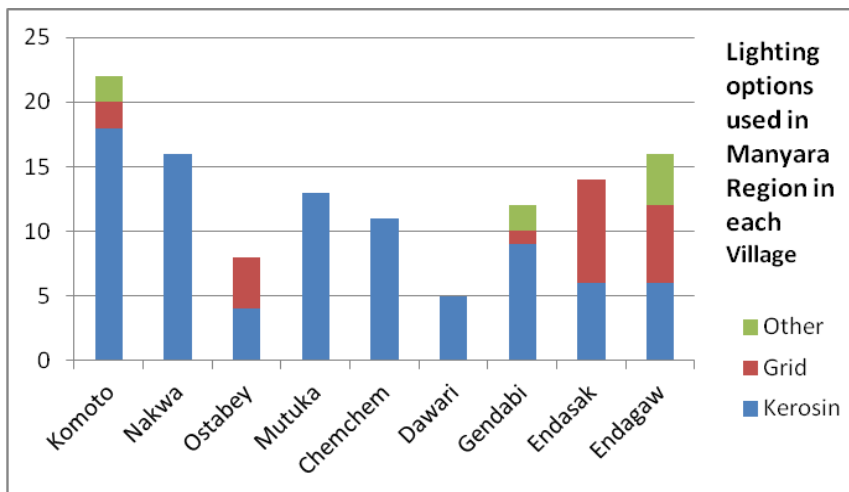
In Arusha region the source of energy for lighting is dominated by kerosine and followed by grid, other technology used are generator, torch, solar lantern and telephone torch.



**Figure 9: Current cooking energy used by village in Manyara**

In Manyara two distinct 9 village were visited and current energy used for cooking at each village is shown from the Table table. Fire wood is leading followed by charcoal and LPG. The liest is kerosine.

**Figure 10: Current energy used for lighting by village in Manyara.**



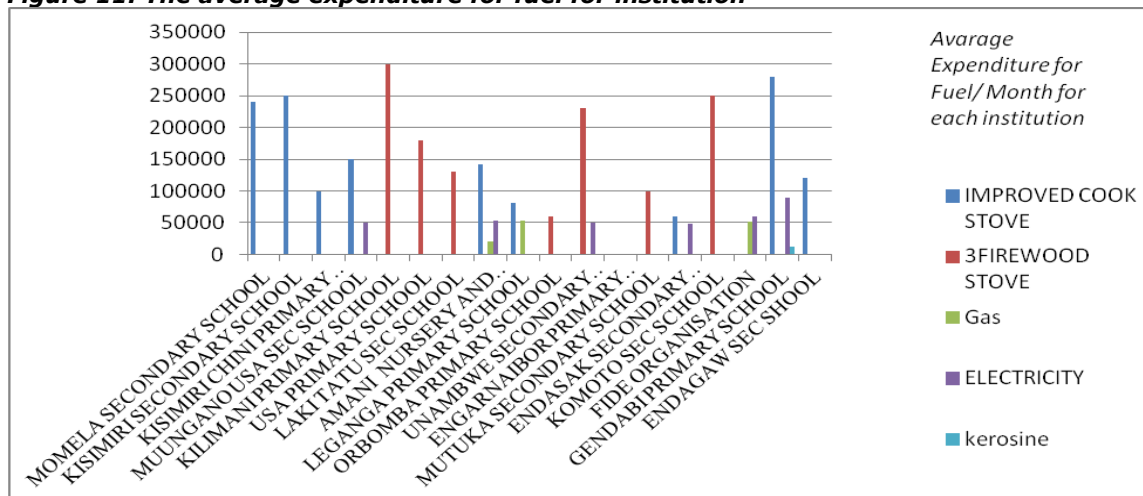
In Manyara region the source of energy for lighting is dominated by kerosine and followed by grid, other technology used are generator, torch, solar lantern and telephone torch.

### 6.3.2 Institutional survey

There are different types and size of ICS for cooking and energy for lighting disseminated and used for domestic and commercial operation. It caters for 3 types of stoves: (a) metal stoves, (b) ceramic stoves and (c) large stoves for institutions; Solar lantern of different size and solar system are available in Arusha and district towns.

The survey shows that 81.76% of the total institutor sample depends on biomass source of energy for cooking this includes fire wood and charcoal. From table below 18 education institutions were interviewed; 42.49% use institutional improved cook stove with fire wood or charcoal, 39.27% use three stone fire place using firewood and 3.95% use gas for cooking. None of them are aware of briquette and other source of biomass source of energy produced from agricultural residue. They are used to firewood and charcoal and experience indicates usage of around 0.6 kg of firewood per meal per student.

**Figure 11: The average expenditure for fuel for institution**



### Energy Source for Lighting

From the sample survey show that grid connection is in 6 schools out of 18 which is (33.33%) solar 22%, wind 11.8% and kerosene 11.8% and 21% are not boarding school.

### Cost per months

Schools buy firewood, charcoal and gas for their daily cooking activities and electric, fuel for generator and kerosene for lighting, the expenditure per month depends on the size of the school infrastructure, number of student and whether is the boarding school or day school.

### 6.3.3 Entrepreneurs and business demand survey

Consultant visited 24 food venders and 22 restaurants to understand the type of fuel and technology they use for cooking and lighting. At village level 60% were using firewood 30% kerosene and 10% charcoal for cooking and the amount of wood used was 2 to 3 bundles of 5 kg each per day depending on the level of business. The average price per bundle is Tshs 2,000 and expenditure on fire wood therefore is between Tshs 4,000 to Tshs 6,000 per day. For those using charcoal they were using one tin of 10 lts charcoal which cost Tshs3, 500 in rural area and Tshs7, 000 in urban area per day. LPG and kerosene are used to warm food and for fast cooking.

All restaurants and food venders are using different technology for cooking including traditional cook stove made of steel and car drum they like this technology because they are robust and easy to manufacture and cheap compare to improved stove. Their ability and willingness to pay for ICS is between Tshs 15,000 to Tshs 20,000 if the cook stove could withstand cooking different types of food like Ugali. All owners were aware of existence of improved charcoal stoves but they did not have knowledge of their benefits in terms of fuel saving. Despite that firewood availability is a serious problem to them.

Restaurants in towns were mainly using charcoal and LPG but food vendors in towns were using charcoal. The vendors operate their businesses along the road side in the market centre and bus stand. Food vendors are aware of benefits of improved cook stoves but are not interested in using them for reasons of having

short life span of cladding that demands frequent repairs of the stoves and not user friendly when cooking food like ugali.

### 6.3.4 Consumer preferences for cooking and lighting technologies

A finding from the consumer side shows they use different kinds of technologies for cooking different type of food and lighting for deferent purpose. The following **table No 7** below shows the lists of technology common in use within the area and the reason why they are in use. More than 70% household use more than one type of stove or technology for cooking and lighting. This is driven by the source of fuel available type of food and the size of the port and for lighting depend on size of the house and time when the energy is needed.

**Table 7: Technology currents in use for cooking and the reasons for choosing**

SN	Technology available for cooking.	Technology in use in %	Reason for choosing the technology or not.
1	Three stone cook stove	77.8%	Most used in rural area, it cost nothing, easy to make, flexible in size, using firewood of different size, wet and dry and readily available in rural area.
2	Traditional charcoal stove	14.2%	Most used in Peri urban area, cheap to buy and local made, easy to use, provide heat, using charcoal readily available in the area.
3	Improved firewood stoves	2%	Most used in Peri urban and town area, Expensive to buy and not easy to make, delicate to use, using charcoal readily available in the area.
4	Improved charcoal stoves	4%	They like it because it reduce the usage of charcoal than the one made by metal only.
5	Saw dust stoves		They are easily available technology and locally made, sawdust is cheap.
6	Kerosene stoves	5.2%	Most of employees use this and it's cheaper than LPG and faster than charcoal stove.
7	ICS pellet stove	0	Not known and unavailable.
8	ICS briquette	0	Not known and unavailable.
9	LPG stoves	1.4%	Readily available at petro station expensive but easy to use and fast in cooking.
10	Biogas	0.27%	I have cow which produce cow dung, there is local fund to construct and provide after sale service. I am aware of the benefit for biogas.

**Table 8: Technology currents in use for lighting and the reasons for choosing**

SN	Technology available for lighting	Technology in use by %	Reason for adopting the technology
1	Kerosene lantern	62.7	Most available technology and cheap energy source everywhere available supported by kerosene.
2	Kerosene lamps	62.7	Most available technology and cheap energy source everywhere available supported by kerosene.
3	Electricity	10.5	Cheap and easy to use, clean and provide extra services like ironing, listening Radio, TV and fridge.
4	Solar	20.3%	Provide clean energy for lighting, radio and TV, It is one time investment not the same as electricity.
5	Torch	5%	It is only cheap technology I could get to get the



			light during night.
6	Candle	2%	It is cheap and easy to use.

Cost/price incurred/ paid by consumers to access various types of cooking and lighting options available in target areas. The rural segment mostly relies on collected solid fuels and has very low willingness to pay. Peri-urban respondents buy their fuel but have very low purchasing power.

**Table 9: Cost price of energy**

Cost price of energy for cooking		
Type	Cost/day in Tshs	Price cost per unit
Fire wood	2,000	2,000 @ bundle
Charcoal	2,000 – 7,000	13,000 - 25, 000 @ bag
Kerosene	2,000 – 4,000	2,200 @ litter
Biogas	? need to be calculated	800,000 @ plant
LPG	800 - 1,800	3,350@kilo
Cost price of energy for lighting		
Type	Cost /day	Unit Price
Kerosene.	500 – 2,000	2,200@liter
Electric	330 – 1,700	10,000 - 50,000 @ month
Solar	? need to be calculated	2,000 – 2,700@ Watt peak,
Candle	300 - 500	300 – 500@ pc
Generator	2,500	2,200 diesel @ litter
Torch.	-	2,000-2400 battery @ month

The rural segment mostly relies on collected solid fuels and has very low willingness to pay. Most of peri-urban and urban respondents buy their fuel but have very low purchasing power to access modern technologies.

The cooking in Arusha region is dominated by fire wood in rural area which is estimated at Tshs 15,000/= at a household level to Tshs 550,000/= for institutional. Charcoal, Kerosine and LPG are used within town at the cost of Tshs 2000 to Tshs7,000 . Lighting is dominated by Kerosine and grid electricity quite few people are using other source of energy like lantern and candles.

### 6.3.5 Households levels of awareness and adoption of ICS

There is a low level of awareness and adoption of Improved Cook Stoves in Arusha and Manyara region. Of the surveyed households in the region few had either heard or seen ICS as shown in the figures below. Those who had heard of or seen ICS were not using them reason being the upfront price which they cannot afford.

**Figure 12: Limitation of RETs adoption in Arusha region**

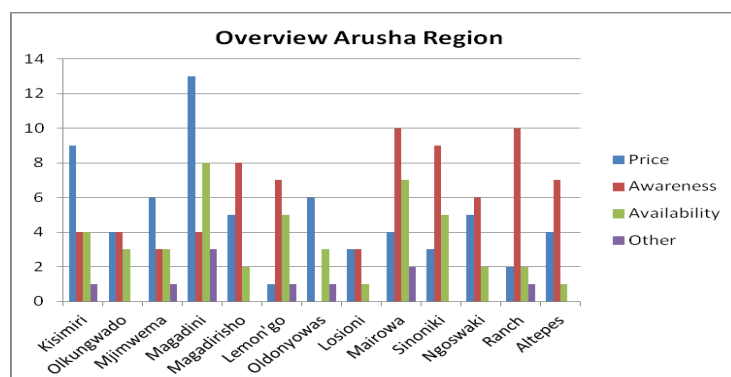


Figure 12 Show an overview of awareness and adoption of ICS and other RETs technologies from different village in Arusha region.

**Figure 13: Limitation of RETs adoption in Manyara region**

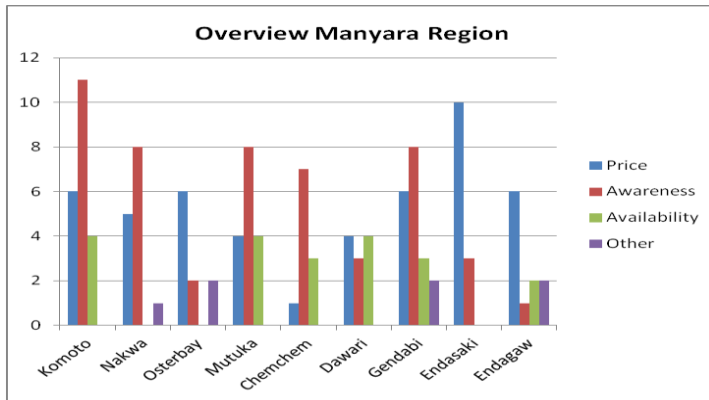
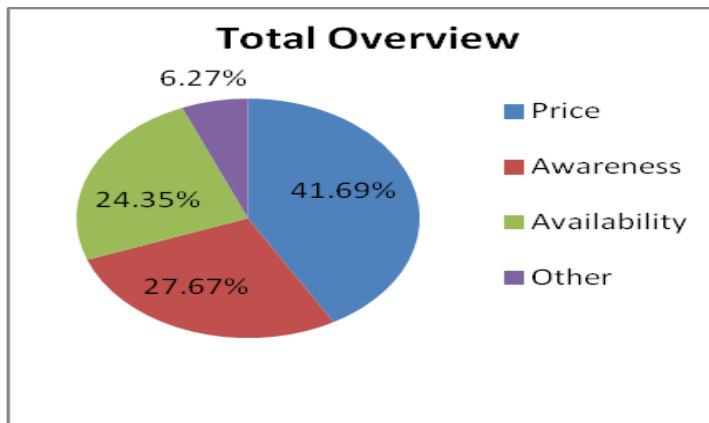


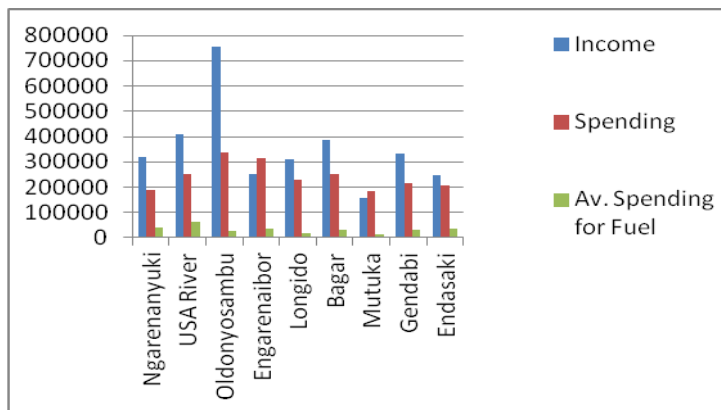
Figure 13 show an overview of awareness and adoption of ICS and other RETs technologies from different village visited in Manyara region.

**Figure 14: Overall overview of limiting factors for RET adoption by potential customers**



The figure shows an overview of what are the limiting factors that influence potential customers not to access ICS and RETs technology in Arusha and Manyara region combined. Upfront price is the leading at 41.69% followed by not aware at 27.67% then availability of technology to their area 24.35% the rest 6.27% not respond.

**Figure 15: Income and average spending on fuel**



The Figure shows the total income and expenditure compare to energy expenditure from 9 selected Wards of Arusha and Manyara regions.

As fuel prices for cooking account for a big part of people's expenditures, the following table shows the prices for fuel as a percentage of the household's income. Only households that buy or buy and collect cooking fuel are regarded:

The highest income for household per month is Tshs 757,242/= and the lowest income is 155,548 at an average of Tshs

456,395/=, the highest expenditure for energy per house hold is 61,912/= and the lowest is 14,968/= give an average of 38,440/=. The average expenditure for fuel is equal to 8.4% of the total average income. Fire wood cost a family an average of Tshs 2,000/= per day, charcoal 4,500/= and Kerosene 3,000/= LPG 3,533/=, for cooking. Kerosene cost a household Tshs 1,250/= an average per day, electricity 1,000/=, Generator 2,500/= torch of telephone & candle used at minimum cost for lighting.

### 6.3.6 Demand for renewable energy and ICS

The table below show the people are ready to change their cooking and lighting source of energy to renewable if the barrier mentioned above is mitigated.

**Figure 16: Demand of RETs in Arusha**

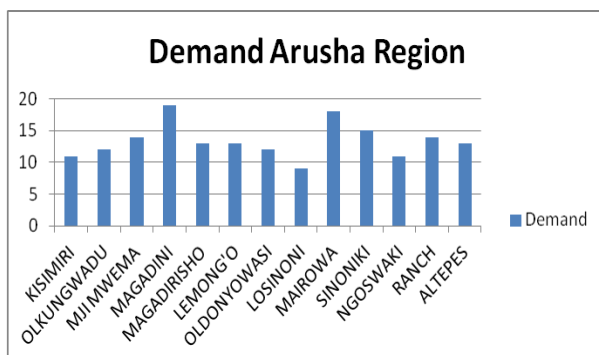


Figure 16 demonstrates and show level of interest in response at each village visited in Arusha region.

**Figure 17: Demand of RETs in Manyara**

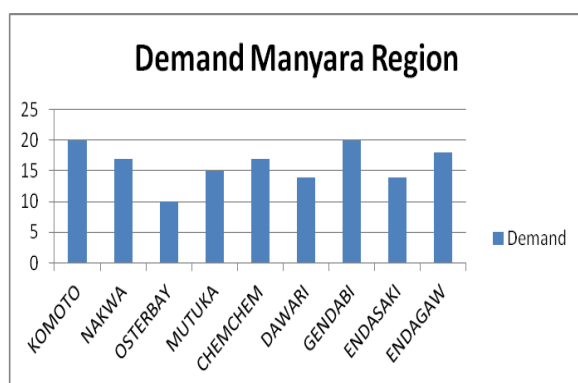


Figure 17 demonstrates and show level of interest in response at each village visited in Manyara region.

When asked how much they are willing to pay for RETs; households are willing to pay ICS at the range 5000 – 25,000 and 10,000 up to 20,000 solar lantern, and Tshs 200,000 – 500,000 for solar system. On average, they are willing to pay between TZS 5,290 and TZS 11,239 per month. This amount is below the current expenditure on kerosene and dry cells for lighting. This can be explained by current expenditure patterns on kerosene that involves purchase of fuels on daily basis.

## 6.4. Enabling Environment Survey

The consultant directly interviewed actors and stakeholders in the enabling environment as per the guidance of the data collection tools developed and the following is the result.

### 6.4.1 Local Government Authorities

The discussion aimed at understanding if districts have any program/policy supporting promotion of RETs and especially ICS and biomass source of energy for cooking discussion involved district planning officer and natural resource officer within the district authority. It was made clear that the conventional energy sector, and in particular the electricity sector has not lived up to expectations. The sector is mainly characterized by unreliability of power supply; low access levels; low capacity utilization and availability factors; deficient maintenance; poor procurement of spare parts; and, high transmission and distribution losses among other problems.

Experience in the surveyed districts shows that the introduction and success of any renewable technology is to a large extent, dependent on the existing government policy; Government policies are important factors in terms of their ability to create an enabling environment for RETs dissemination and mobilizing resources,

as well as encouraging private sector involvement and investment. In our discussion at the regional level and district level many issues have been raised and concluded as following:

- Limited policy support for renewable is further demonstrated by inexistence budgetary allocations to renewable in most districts. The ministry of energy place more emphasis on the petroleum, natural gas and power sectors, which supply a small portion of the population, than on renewable (especially biomass) which supply a large portion of the population.
- There is growing consensus among policy makers at district level that efforts to disseminate RETs in Tanzania have fallen short of expectations. While it is recognized that RETs cannot solve all of Tanzania's energy problems, RETs are still seen as having a significant unexploited potential to enable the government to meet its growing energy requirements especially ICS and biomass energy for cooking which attract 98% of household in Tanzania. Renewable energy is already the demand and dominant source of energy for the household sub-sector (biomass energy). If properly harnessed, it could meet a significant demand of cooking energy at Institutional and household level in proportion of energy demand from the industrial, agricultural, transport and commercial sub-sectors.

#### **6.4.2 Civil Society**

The interview to civil society shows that despite the well-known benefits of improved cook stoves and clean energy for lighting, the replacement of the traditional cook stoves is not occurring at the rate that it should. This is due to a number of barriers that are preventing such scale-up: Market-based dissemination methods have natural limits. Many people cannot afford even a modestly priced ICS because their incomes are simply too low. Micro-credit loans and other creative mechanisms can increase affordability in some cases; this approach will not extend affordability universally. In short, the free market will not be able to deliver renewable energy and energy efficiency products and services to people who truly cannot afford them, and these very low income people are among those who are most in need. This limitation can be lessened with well-directed subsidies that lower the cost for a cook stove for households that do not have sufficient purchasing power.

The approach for market hub practices by Mobisol and Rafiki market agent established by GSC paid on commission of what they sale is very much appreciated and accepted by many entrepreneurs. Mobisol is one of the private firms providing a prepaid business model for solar home system to household direct. Many people have been attracted with this approach 1,000 solar system of different size 30W, 80W, 120W and 200W were accessed by the market in two years.

Imported stoves such as the Envirofit wood stove have also been introduced by L,Solution to the market but the number of distributors is low since it is a resource intensive activity. Other local manufactured ceramic stoves from Same and Dar Es Salaam which have also been tested in the market, and distributed.

Biogas is promoted by CAMARTEC under the Tanzania Domestic Biogas Program with the aim to commercialize this technology through building capacity of biogas contractor enterprise (BCEs) for installation and providing after sales service.

Mobisol, Wodsta, GCS and OIKOS established the market hubs in the village to make sure the product is at proximity to the village where it is needed. The approach need to be encouraged and supported by village government leaders.

Embark energy provide training on business planning for clean energy entrepreneurs who wish to start the business or scaling up. They are also match making the entrepreneurs and impact investors once their business plan is complete and balance for investment.

A variety of stakeholders exist in the cook stove sector although experience and commitment in promoting improved cook stoves and other RETs may vary. A lot of stove production is done through informal businesses and artisans. Many producers will source out the making of liners and complete the cladding and assemble of the stove. Small artisans often work closely together at SIDO and CAMARTEC and TEMDO

incubator program within their premises. Quality clay is available in Pare Mountain and Singisi in Meru and Karatu. Finished products are transported from commercial manufacture from Dar and Pare. The rest are imported stove from abroad including China.

### 6.4.3 Finance

When energy financing financial institution financial institution need to give consideration to the value chain analysis, consultant focus mainly on the existing energy which include larger institution institutional investor, financial intermediary (village credit facility, local bank, rural SUCCOS and cooperative) local energy retailer and the end user.

Arusha and Manyara has local and international banks at regional headquarters, community banks and MFI at district level, and SACCOS and Community credit facilities almost in all village. Medium-term investment credit and venture capital is almost totally unavailable within the regions. However, a number of microfinance institutions are providing small loans with very short terms and frequent small payments, geared mostly toward buying and selling activities. Such loans benefit the poor by providing a daily source of income through petty trade. Investment loans to support business expansion, especially for new and innovative ventures are not found.

Opportunity to finance energy enterprises is obvious this include finance loan to consumer through SACCOS, financial model to finance entrepreneurs on clean energy through MFI and community banks. The financial model to bridge the gap between financial institution, client and Energy Company is necessary to commercialize the products in this sector. Capacity building to financial institution is very important to let them understand the sector, the risk and opportunity available.

## 6.5 Supply Chain Survey

In this topic consultant directly interview and assess ICS, biogas and solar lighting supply chains (actors) in the target regions. The survey aims at identifying existence of developers/ suppliers/ distributors/ transporters of ICS, biogas and solar PV technologies and services available in the target regions; and also provide information on challenges, opportunities and preferences for an improved scenario. The findings include number of manufacturers, importers, suppliers, distributors, transporters, retailers and after sale service providers of cooking and lighting technologies in target regions.

Finished products are transported from commercial manufacture from Dar Es Salaam to Arusha town and Babati then transported to wholesale and distributors' shops in all district towns then from there distributed to village centres. Most of goods are from Dar es Salaam, Arusha or Nairobi and abroad especially solar. The following table provides the list where the community member accesses their energy technology and types of the energy mostly sold.

**Table 10: Potential service providers**

SN	Potential service provider	What they provide to the market.
1	Petro stations in the highways and within regional town.	Provide access to kerosene and LPG, diesel for generators.
2	Retail shops in every village.	Provide access to Kerosene, batteries and candles.
3	Central market in every regional town.	Provide cook stoves of various types and size (ICS and TCS)
4	Opening market in every village.	Provide different energy services including fire wood Charcoal, kerosene, solar lantern.
5	Electrical and hardware shops.	Provide electrical appliances and solar equipment.
6	Agricultural companies, NGOs and Government extensions workers	Provide agricultural input, extension services in the market and create awareness through project interventions.

7	Local capacity builders and BDS provides	Provide business development training and capacity building to the local clean energy entrepreneurs.
8	BCEs	Provide technical services for Biogas technology, contraction and after sale services.
9	Financial institutions including banks and Cooperative and community banks	Provide financial services to manufacture, supplier and distributor, SACCOs provide financial to consumers.

### 6.5.1 Improved Cookstoves (ICS)

A lot of stove production is done through informal businesses and artisans. Many producers source out liners and complete the cladding and assemble of the stove. Small artisans often work closely together at SIDO and CAMARTEC and TEMDO incubator program. Quality clay is available from Pare Mountain and Singisi in Meru and Karatu. Efficient charcoal and wood stove are imported from China and distributed in Arusha and Manyara and Institutional cook stove are manufactured by local artisan and installed to many institutions in both regions. The table below shows the list we were able to identify:-

**Table 11: List of micro businesses and services they provide**

SN	Micro business	Location	Service provided	Product
1	PY ENGINEERING Ltd	ARUSHA	Manufacturing and promotion of PY Cook stove in Arusha Kilimanjaro Manyara Morogoro and Dar.	CHASS - Cook stove
2	TREE Ltd	ARUSHA	Distribution of Solar kits and ICS JIKO Bomba and Pallets to different market in Arusha Kilimanjaro.	Solar Kits Barefoot, Jiko bomba and Moto bomba.
3	Kiwi and Laustsen	ARUSHA	Distribution of Solar kits, ICS and Pallets to different market in Arusha Kilimanjaro.	Solar lantern cook stove and pellet.
4	Estec		Production and installation of community cook stoves.	Institutional cook stove
5	Shaffi K. Msuya	Arusha	Stove whole seller at the central market.	ICS and TCS
6	Makoga Shukrani	Arusha	Stove retailer and whole seller in Central Market.	ICS of different size and TCS
8	EAST AFRICA BRIQUATE CO	ARUSHA	Production and distributor of efficient community cook stoves.	Briquette
9	KAIHURA	ARUSHA	Production and installation of community cook stoves.	Institutional cook stove
10	L-Solution	ARUSHA	Provide solar equipment and imported cook stove.	Wooden stove and solar equipment
11	Ndekirwa Kitomari	ARUSHA	Making of cook stove liner.	Cook stove liner.
12	Kimario	Arusha	Designer and producer of different types of ICS at SIDO premises.	ICS of different design.
14	Green Energy Solution	Arusha	Produce bio-charcoal for commercial market.	Bio-charcoal.

### 6.5.2 Solar products

There are different types and size of Solar in the market, they varies from lantern, Pico solar, solar home system and solar mini grid. The systems are imported from Europe and China. Distributors are mainly in Arusha and Babati, there are several companies that are majoring in this sector. The following table provides the list:-

**Table 12: Solar providers**

SN	Micro business	Location	Service provided	Product
1	Mobisol UK Ltd	ARUSHA	Prepaid system through marketing hub established in Arusha, Kilimanjaro and Manyara.	Mobisol solar system
2	Global cycle Solution	ARUSHA	Distribution of Solar lantern to different market in Arusha Kilimanjaro.	Solar Portable Lights (SPL)
3	TREE Ltd	ARUSHA	Distribution of Solar kits and ICS JIKO Bomba and Pallets to different market in Arusha Kilimanjaro.	Solar Kits Barefoot, Jiko bomba and Moto bomba.
4	DLIGHT/ Benson	ARUSHA	Distribution and marketing of the DLIGHT products in Arusha Kilimanjaro and Manyara.	Solar Portable Lights (SPL)
5	Kiwi and Laustsen	ARUSHA	Distribution of Solar kits, ICS and Pellets to different market in Arusha Kilimanjaro.	Solar lantern cook stove and pellet.
6	M-Power	ARUSHA	Provides off grid energy services on monthly services.	Solar kits.
7	Power provider	ARUSHA	Provide off grid solutions	Solar kits
8	Cloride Exide	ARUSHA	Distributor of Solar equipment in Tanzania.	Solar system and equipment.
9	Helvetic	ARUSHA	Provide solar design supply of equipment and installation.	Solar system and equipment such as solar heaters.
10	L-Solution.	ARUSHA	Provide solar equipment and imported cook stove.	Wooden stove and solar equipment

### 6.5.3 Biogas technology

Biogas is promoted by CAMARTEC under the Tanzania Domestic Biogas Program with the aim to commercialize this technology through building capacity of biogas contractor enterprise (BCEs) for installation and providing after sales service. There are 14 biogas contractor enterprise for Arusha and Manyara region this include OSES Company Limited, Danko Company, Roja Company Limited, Biogas Building and Construction, Mkombozi Biogas, Construction Company, G. Sulle Company, Mathiya Biogas Installation and Innovation Company, ORON Biogas Company Limited, Saramay Construction and Energy Company Limited, Kitete Energy Company, Goshem Company Limited, Keep Green Biogas Construction and NAGEMA Biogas Company.

Cost/price incurred/ paid by consumers to access various types of cooking and lighting options available in target areas. The rural segment mostly relies on collected solid fuels and has very low willingness to pay. Peri-urban respondents buy their fuel but have very low purchasing power.

## 6.6 Agricultural and rural penetrating companies with extensive outreach

In this section the consultant assesses existence of agricultural companies, livestock networks, and other rural penetrating companies with extensive networks and explores possibilities of becoming distributors of ICS and solar products.

Arusha and Manyara is dominated by agricultural and livestock sector for the most consultant assess the existence of agricultural companies, livestock networks, and other rural penetrating companies with extensive networks and explore possibilities of becoming distributors of ICS and solar products.

**Table 13: Agricultural and rural penetrating companies with extensive outreach**

Agricultural companies	Major products	Members	branches	Potential for ICS distribution
MVIWATA	Networking and advocacy.	All over Tanzania.	Arusha & Manyara	Promotion and distribution through its members.
TAMPA	Milk products networking.	All over Tanzania.	Arusha & Manyara	Promotion and distribution through its members.
TCCIA	Business and agricultural networking.	All over Tanzania	Arusha & Manyara	Promotion and distribution through its members.
TFA	Agricultural input.	Manyara and Arusha.	Arusha & Manyara	Promotion and distribution through its members.
TAHA	Horticultural Networking.	All over Tanzania.	Arusha & Manyara	Promotion and distribution through its members.

## 6.7 Energy options analysis

Here consultant compare various alternative energy cooking solutions /options available in target regions to establish individual technologies life cycle costs analysis of available options and cost benefit analysis. Where possible, consultant shall purchase sample products of different ICS encountered in the field during MI surveys.

Finding from this research sample show that 98% of the house hold in Arusha and Manyara use biomass for cooking (charcoal ad firewood). Within rural areas wood is the main cooking fuel, whilst in urban areas wood, charcoal and Kerosene are used. A variety of energy source and modern technology are available in the market to suit differing end user requirements this include:-

- Biomass pellets made from agro-waste such as rice husks and Jatropha press are being trialed in Tanzania with complimentary clean cook stoves.
- There are also several manufacturers of biomass briquettes made from recycled char and other agro-waste such as coconut shells.
- Biogas is promoted and constructed by biogas contractor companies trained by TDBP.
- Energy efficient cook stove are commercially manufactured from abroad and some are imported for market test in Arusha and Manyara.

Energy option for lighting is solar lantern the research reviled that 67% of the total household use traditional fuel for lighting, this include kerosene, candle and generator, solar lantern and solar system is available in the market, supplier and network of distributors are established. More awareness and benefits need to be created.

**Table 14: Alternative sources of energy for cooking and benefits**

SN	Traditional source of energy for cooking	Alternative renewable energy	Benefit
1	Three stone fire place	Improved wood stove	<b>Improved cook stoves</b> Efficient and clean-burning cooking stoves range from artisanal or semi-industrially produced clay and metal wood-fuel stoves to cookers using fire wood, charcoal, biogas, biomass pellets and briquette. The most widely used technologies of all these stove categories are improved wood stoves and charcoal stoves, since they are more affordable, and the fuel is common in most markets. Improved cook stoves (ICSs) may take many shapes. However, the two main technical principals are always the same: improved combustion and improved heat transfer to
2	Traditional charcoal stove	Improved charcoal stove	



			<p>the pot. Stoves may be mobile such as the clay stove, or in-built.</p> <p>The two main advantages of ICSs are a reduction in indoor air pollution – with huge benefits to people’s health (particularly women and children); and a reduction in fuel required for cooking – with associated savings on time spent collecting firewood, money spent purchasing fuels, reduced impact on forest resources and reduced carbon emissions</p>
3	Fire wood	Briquette and pallet LPG & Biogas.	<p><b>Biogas</b></p> <p>Domestic biogas systems convert animal manure and human excrement at household level into small, but valuable, amounts of combustible methane gas. This biogas can be effectively used in simple gas stoves for cooking and in lamps for lighting. The plant consists of a digester to mix and store the ingredients and a container for the resulting biogas. At least two cattle or six pigs are required to produce enough biogas to meet a household’s basic cooking and lighting needs. Investment costs of quality biogas plants vary between Tshs 800,000 – 2000,000 depending on plant size, location of construction and country. LPG is available from petro station like kerosene easy to transport. Use of gas saves time on cooking processes and firewood collection. Gas burns very efficiently, without producing smoke or soot; reducing resulting respiratory and eye problems. The residue of the process, bio-slurry, can be easily collected and used as a potent organic fertilizer to enhance agricultural productivity. A number of organizations are promoting biogas projects in Arusha and Manyara through TDBP Program.</p>
4	Charcoal	Briquette and pallet LPG & Biogas.	
5	kerosene	LPG & Biogas	

**Table 15: Alternative renewable energy for lighting**

SN	Traditional source of energy for lighting.	Alternative renewable energy	Benefit
1	Kerosene lamp and lantern	Solar lantern	<p><b>Solar photovoltaic (PV)</b></p> <p>Portable solar lantern products are the most affordable form of PV lighting available and are currently in widespread use across southern Asia and east Africa. A number of models are available that are high quality, durable and relatively low cost.</p> <p>Solar home systems (SHS) are a package designed for households and cottage industries, and typically comprise a small solar panel and mounting, rechargeable batteries for energy storage and battery charge controller. The retail price of an SHS ranges from about Tshs 250,000 – 3,000,000 this are 10W to 200W systems, respectively. Special training is required for the caretaker of the system.</p> <p>An SHS with a 60W solar panel in an area with a good solar resource can power four energy efficient lights for up to five hours a night.</p>
2	Torch and candle	Solar lantern	
3	Generator	Solar system	

**Table 16: Prices for different types of cook stoves**

Type of improve cook stove	Price range in Tshs	Whole sale in Tshs	Retail price in Tshs
Efficient cook stove	50,000 – 120,000	47,500 – 10,0000	50,000 – 120,000
Improved cook stove	3,000 – 25,000	2,800 – 20,000	3,000 – 25,000
Traditional metal charcoal stove	2,000 – 10,000	1,500 – 8,000	2,000 – 10,000
Traditional canteen cook stove	15,000 – 60,000	???	15,000 – 60,000
Institutional cook stove	350,000 – 2,600,000	Sale on commission	350,000 – 2,600,000

**Table 17: Price for different types of solar equipment**

Type of solar system	Price range in Tshs	Whole sale in Tshs	Retail price in Tshs
Solar lantern	10,000 – 120,000	10,000 – 55,000	15,000 – 70,000
Sala pico	120,000 – 250,000		
Solar system	610,000 – 2,800,000	530,000 – 2,400,000	610,000 – 2,800,000
Solar panel	2000 -2700 @W	1,800 – 2,200	2000 – 2,700

## 7. CONCLUSIONS

The results of these market demand and financial feasibility analyses and associates sensitivity of market intelligence that can inform key stakeholders in the cook stove market sector including individual households, micro-financing institutions, marketing programs, and manufacturers. The lessons and relevance to each stakeholder group demonstrate the power of this MI towards filling in critical gaps in market intelligence, and how filling those gaps certain market failures are alleviated.

### 7.1 Biomass energy situation

Communities in Arusha and Manyara regions still depend on traditional sources of energy for cooking and lighting. The demand for clean energy and modern technology is high compared to analysis of this report. The total potential demand for modern energy for cooking is 98.33% and for lighting is 65.44% of the total household in Arusha and Manyara regions. Firewood and charcoal are important household fuel and to a lesser extent, commercial fuel. Fire wood is used mostly in rural area; charcoal is mainly used in the urban areas where it is easily stored. High-energy content and lower levels of smoke emissions make it more attractive than wood fuel. It is the primary fuel for the urban poor. And wood is an important household fuel in rural area. The increased use of firewood and charcoal create pressure on the forest and increase deforestation and environmental degradation.

### 7.2 Cooking energy supply options

A number of alternative clean energy and modern technology for lighting which is available for existing market; this includes biogas, pellets, briquette and LPG for cooking. Electricity, solar lantern and solar system are the most available technologies for lighting. Different types of modern technologies are available in the market this include improved cook stoves such as, ICS wood stove, improved charcoal stove, ICS for pellet, ICS for briquette, sawdust stove and LPG stoves and biogas.

### 7.3 Potential modern energy demand for cooking and lighting

There is a big potential for the introduction of solar lantern kits technology in Arusha and Manyara Regions. Through good marketing and awareness creation, a high percentage of the population could be reached, ranging from low-income to high-income groups and grid-connected to non-connected households. Nevertheless, the finding shows that selling solar lanterns through promotion and market agent might not be an ideal way for sustainability of marketing of the RETs. Not only because of the high percentage of promotion but also, because it could be better to sell different solar kits appropriate for a broader use, a different mode of distribution should be tested, even though a big advantage of selling and distributing to entrepreneurs already aware of the appropriate use and can teach their communities creating more awareness on solar lanterns.

If we assume our sample is representative of the entire population of households in Arusha and Manyara regions, 486,439 we can infer that the ICS and clean energy technology is a net positive investment for roughly 476,710, households (98%). Nevertheless, these estimates do not have much predictive power to an individual household within the population. Individual households are each unique; in order to understand the financial feasibility of the potential investment in an ICS, or any other renewable energy or energy efficiency projects for that matter, it is necessary to complete an individual household analysis for each situation which can be on the future plan. Assume this is the total market and 30% is potential market size. Within the observed range of monthly fuel expenditures there is considerable variability in estimates of financial feasibility. The standard deviation of monthly fuel expenditure, decreasing monthly fuel expenditure, decrease in IRR increase in time to payback, decrease in benefit cost ratio is also important thought.

Improved cook stoves are more available around urban centers particularly the central market of the districts in Arusha and Manyara regions. Increasing urbanization and rising charcoal prices is likely to push up demand for efficient stoves, in areas where people pay for fuel. Uptake of LPG is low due to the high upfront cost of the stove and gas cylinder and availability outside urban centers. Most of people in villages have informal (economy) way of getting their income so they do not know the exact amount of income they make per month or per week.

The conventional energy sector, and in particular the electricity sector has not lived up to expectations. The sector is mainly characterized by unreliability of power supply; low access levels; low capacity utilization and availability factor; deficient maintenance; poor procurement of spare parts; and, high transmission and distribution losses among other problems

## **7.4 Energy micro-businesses in the target region**

The choice of renewable energy technologies for dissemination and development in Arusha and Manyara should take into account the existing technical knowledge and local industries. Technologies that improve existing methods and build on already established industries are likely to be successfully disseminated. In addition, these technologies can become self-sustainable in the long-term. The barriers related to technology include lack of skill on the construction and maintenance of ICS and RETs promoting technologies that are not easily disposable for local communities and require importing expensive components.

## **7.5 Challenges and drivers for adoption of modern energy for cooking and lighting**

The mechanisms that define access to an ICS are numerous, and have some overlap with the factors that affect technology and fuel switching and stacking. All of the following mechanisms and /or conditions must be in proper alignment with the idiosyncratic situation of each household seeking access to an ICS:-

1. Purchasing power and availability of credit.
2. Willingness/ability to pay.
3. Availability of products near the home.
4. Accessibility of appropriate fuel types.
5. Knowledge and understanding of potential health and financial benefits.
6. Cultural appropriateness of the technology. Intra-household social relations and their influence on decision.

Market-based dissemination methods have natural limits. Many people cannot afford even a modestly priced ICS because their incomes are very low. Micro-credit loans and other creative mechanisms can increase affordability in some cases; this approach will not extend affordability universally.

Another limitation to the scalability of the market is the upfront cost barrier. Not all of the money that very low income people spend on energy is available at once for large purchases. Household energy expenditures are spread out over the entire year while the cost of a cook stove must be paid in advance. Micro-financing can address this problem by providing small loans that can spread the cost over time. By spreading the cost out over time, some or all of the payments can be made directly from the savings that are generated from the higher efficiency stove.

There are many co-benefits to ICSs that are not easily quantified monetarily including improvements to health and quality of life, and savings in time previously spent collecting fuel wood. Replacement of traditional cooking stoves with ICS can result in substantial economic benefits for the average rural household. However, with the majority of households reporting total household monthly incomes of less than Tshs 456,395, the up-front cost is a significant barrier. Mobisol is addressing this barrier by investigating micro-financing mechanisms which can spread up-front cost over time. A favorable micro-

financing scheme is imperative to making the ICS accessible to the average household. For the 98% of the household that reportedly collects or buy fuel wood, the economics do not make sense unless these households can substitute remunerated activities for the time they save on collecting fuel wood.

## 7.6 Lessons from other energy related organizations

**Imported stoves:** Envirofit wood stove have also been introduced by L,Solution to the market but the number of distributors is low since it is a resource intensive activity. Other local manufactured ceramic stoves from Same and Dar Es Salaam which have also been tested in the market, and distributed.

**Biogas:** CAMARTEC under the Tanzania Domestic Biogas Program with the aim to commercialize this technology through building capacity of biogas contractor enterprise (BCEs) for installation and providing after sales service.

**Solara kits and systems:** Mobisol, Wodsta, GCS and OIKOS established the market hubs in the village to make sure the product is at proximity to the village where it is needed. The approach need to be encouraged and supported by village government leaders.

**Training for clean energy entrepreneur:** Embark energy provide training on business planning for clean energy entrepreneurs who wish to start the business or scaling up. They also match making the entrepreneurs and impact investors once their business plan is complete and balance for investment.

**Financing for entrepreneurs:** TDBP has established the link with SACCOS and community bank to offer credit to manufacture and end user this is case to learn and scale up

## 7.7 Potential distributors of energy products

Arusha and Manyara region has a lot of potential distributors for ICS and RETs for lighting. This include hardware shops in the district towns, retail shops within the village town, and market agent who will take the products to the open market in all Wards of Arusha and Manyara regions.

Opening of the market hubs within the village where the stock of products will be stored and market agent hired to promote the technology and local technician to provide after sales services. This will create more employment at lower cost but the advantage is sustainability of the product and knowledge.

There is several number of agricultural and rural penetrating companies which dealing with agricultural input and buying the agric- products this includes TFA, TAMPA, TAHA, MVIWATA

## 7.8 Availability of energy products in the study area

Production of improved cook stove is done through informal businesses and artisans. Many producers will source out the making of liners and complete the cladding and assemble of the stove. Artisans often work closely together at SIDO and CAMARTEC and TEMDO incubator program within their premises. Quality clay is available in Pare Mountain and Singisi in Meru and Karatu. Finished products are transported from commercial manufacture from Dar and Pare. The rest are imported stove from abroad including China.

Solar kits are imported from aboard by supplier existing in Dar and Arusha, there are several company who are majoring in this sector based in Arusha. This include; Mobisol, GCS, DLight, Rex Investment, M-Power, Tree, Iconic, Solar planet, Helvetic and Chloride Exide. Awareness need to villages based to household level which will make them aware on RET's. They suffer from IAP for those who are using 3 stones. Demand of solar lantern is high because they can afford it than solar home system due to the cost.

## 8. RECOMMENDATIONS

The market intelligence for ICS and clean energy for light is defined and conducted at these regions to address a regional road map for the application of renewable energy and energy efficiency cook stoves technologies to increase access to energy services towards the attainment of the ICS taskforce targets. The research team identifies six key focus areas to be addressed during the next five years: (a) policy frameworks (policy, legal and regulatory frameworks) including standards, (b) establishment of a national action plan for renewable energy and energy efficiency for networking, knowledge sharing and data collection, (c) appropriate renewable energy solutions and potential for increasing universal energy access through these networking, (d) capacity building and training, (e) financing mechanisms, fund mobilization and business models and (f) effective monitoring and evaluation mechanisms.

The success of RETs in the region has been limited by a combination of factors which include: poor institutional framework and infrastructure; inadequate RET planning policies; lack of co-ordination and linkage in the RET programs; pricing distortions which have placed renewable energy at a disadvantage; high initial capital costs; weak dissemination strategies; lack of skilled manpower; poor baseline information; and, weak maintenance service and infrastructure.

The following policy options could contribute to the development and dissemination of successful RETs programs in the region:

- Long term RETs policy program within government.
- Careful selection of RETs that is appropriate to Tanzania, and implementation of sustained capacity building programs.
- Instituting innovative financing mechanisms and tapping into financing opportunities such as CDM and micro-credit institution.

The following core goals are proposed here:

- Identify and unlocking new opportunities through access to information and market intelligence for ICS and RETs in general.
- Providing access to flexible investment mechanisms that support ICS enterprises at different levels of innovation and value chain supply.
- Building innovation capacity through delivery of advice, assistance and educational products related to ICS and RETs.
- Provide access to facilities that support rapid technology design, adoption, prototyping, market testing and mass manufacturing.
- Enabling collaboration and developing policies that support ICS and RETs in general at the region and district level.

## ANNEXES

- ANNEX 1: TERMS OF REFERENCE FOR THE STUDY
- ANNEX 2: LIST OF CONTACTED PERSONS IN THE STUDY AREAS
- ANNEX 3: INSTRUMENTS USED DURING THE SURVEY

# ANNEX 1: TERMS OF REFERENCE FOR THE STUDY

## Terms of Reference For Market Intelligence on ICS in Arusha and Manyara Regions

### 1. Background and Rationale

In January 2011, SNV Tanzania supported a desk study on the household Improved Cook Stoves (ICS) sector in Tanzania, to get an in-depth understanding of the sector and its challenges. The results of the desk study were discussed in a multi-stakeholder workshop in Arusha on March 25<sup>th</sup> 2011. One of the key findings of the study is that *“Improved Cook Stoves (ICS), have been studied, promoted and commercialized in Tanzania since the 1980’s. However, despite many efforts by a wide variety of stakeholders, the actual use of ICS remains limited”*. This finding is further qualified by the UNDP’s report (2009) which indicates the ICS uptake to be merely 1% of all households; and estimates from TaTEDO are 10-20%.

The major challenges in the household ICS sector as researched by SNV are:

- The sector is informally organized and lacks adequate communication, coordination and advocacy mechanisms on issues defined below
- The sector has limited product diversity meeting consumer fuel use-cooking practice needs
- The sector lacks economies of scale, which leads high cost of production and transaction and poor competitive advantage
- The sector lacks sustainable working distribution models, with inadequate private sector development and participation; it is more being potentially limited in functionality and/or under-utilized in development efforts
- Research and development is needed to assess the potential of a variety of appropriate ICS technologies and fuels/inputs
- Lack of knowledge on user segmentation, needs, satisfactions, sensitization and experience with regard to ICS
- Lack of knowledge on geographic areas (urban vs rural) and their characteristics with regard to ICS
- Little evidence-based awareness on ICS benefits (health, monetary, efficiency, labour-time, gender)
- Lack of clear policies and strategies to support the ICS sub-sector
- Insufficient business development skills and capacity among small entrepreneurs

These challenges triggered key actors to form an ICS Task Force. The Task Force was formed in March 2011 and it consists members from the Rural Energy Agency (REA), Ministry of Natural Resources and Tourism (MNRT), Tanzania Renewable Energy Associations (TAREA), Tanzania Traditional Energy Development and Environment Organization (TaTEDO), SNV, Round Table Africa (RTA), Ministry of Energy and Minerals (MEM), Tanzania Bureau of Standards (TBS), Tanzania Private Sector Foundation (TPSF), University of Dar es Salaam (UDSM), Sokoine University of Agriculture (SUA), Sustainable Energy Development Centre (SEDC) and the Commission for Science and Technology (COSTECH). In a Stakeholders meeting held in December 2012 at the College of Engineering and Technology, of the University of Dar es Salaam, Envotec was added to the list, as a representative of ICS makers. TAREA is the Secretariat of ICS Task Force.

The ICS Task Force intends to develop an impact oriented, private-sector led, commercially viable, and sustainable ICS sub-sector in Tanzania, and prioritized the following:

Phase 1: Coordination of the ICS sub-sector and stakeholders to better understand and develop the ICS sub-sector through multi-stakeholder processes and feasibility studies. Feasibility studies will include policy analysis, market intelligence and technology assessment.



Phase 2: Based on Phase 1, develop the Programme Implementation Document (PID) to implement a national ICS programme.

## 2. Objective of the Assignment

Lack of clear and reliable ICS market information and data is among key factors hindering wide scale and sizable commercialization and dissemination of ICS in Tanzania. In addition, such lack of information, adversely impact on effective coordination, financing, effective recognition by the government, and sizable private sector involvement in the subsector. The objective of the assignment is therefore to establish market information on ICS and RE in general, including supply and demand sides data, supply chains, existing gaps and threats, strength and opportunities, consumer options and preferences, and propose areas for improvement including institutional, financial and value chain addition arrangements. The findings of Market Intelligent (MI) from these three regions together with that of Lake Zone (already concluded) will, together with the ICS policy assessment and technical status report, finally be used as an input for a ICS sector development Programme PID planned for conclusion in November 2013.

### Specific objectives

- To assess the biomass energy situation in the targeted area.
- To provide data on current cooking energy supply options: document the main energy products and services that are available in targeted regions particularly for both households and institutional cooking and lighting (firewood, charcoal, briquettes, pellets, sawdust, LPG, crop residues, husks, kerosene, dry cell torches, candles, car batteries, electricity, etc.).
- To identify evidence of the potential energy demand for ICS cooking, biogas and (solar) lighting products in target areas and distances people currently travel to access such products and or services.
- To estimate the number of micro-businesses per 1000 households within the target areas.
- To assess the extent to which micro-businesses already exist which are seeking to supply the market of ICS, cooking energy and lighting products.
- To assess the readiness of non-energy entrepreneurs in the target areas to engage in providing energy services such as ICS, biogas and (solar) lighting products distribution
- To analyse the main challenges and drivers to adoption and scaling up of ICS and other RE technologies and key lessons learnt from existing experience.
- Describe the activities of other organizations that are operating within the household clean energy sector, which are of particular relevance to ICS subsector including main activities, approach taken and lessons learnt from their experience.
- To identify the bio mass cooking and lighting energy entrepreneurs in the study areas.
- Identify and quantify indoor air pollution data/ information from relevant institutions, actors and cook stove end users.
- To map agricultural companies and others penetrating in rural areas with extensive networks, as potential distributors of cooking and lighting technologies
- To assess the market availability of products to consumer energy uses, etc.

## 3. Methodology

Methodology to achieve the objectives above shall include:

- Site visits, interviews and consultations
- Literature review for secondary data collection
- Administration of semi structure data collection tools including questionnaires.
- Data compilation, analysis and reporting
- Validation and verification workshops/ meetings with data providers and policy makers
- Findings documentation and dissemination

In situations where reliable data required is unlikely to be available from secondary sources, primary field research will be conducted including:

3.1 ICS and RE related micro-businesses survey to:

- Assessing the number of micro-businesses involved in energy businesses and particularly cooking and lighting energy.
- Assessing the number of micro businesses in RE services (small kiosks, food vending, others.)
- Understanding the challenges these businesses face.
- Assessing the level of interest amongst non-energy micro- entrepreneurs in entering the market.

3.2 Consumer survey: (these should be a mix of households and local traders such as street food vendors, small local shops etc that could benefit from productive use of energy)

- Assessing the current consumer source of energy for cooking and lighting.
- Assessing barriers and perception to uptake of energy products
- Assessing the distance to such energy sources and the cost per unit volume or weight
- The demand and willingness to pay
- Assessing indoor air pollution awareness and incidences/ impacts reported/unreported, known/unknown.

3.3 Survey on agricultural and other rural penetrating companies with extensive networks

- Identify agricultural and other rural penetrating companies such as those contracting large number of farmers
- Assess their geographical coverage, outreach to farmers (numbers), how they organize their channels with farmers,
- Assess their interest as potential distributors of solar/ICS in their geographical coverage.

#### 4. **Expected outputs**

- Population size for the target areas and population density.
- Socio demographic profile of the population in the target areas.
- Quantitative information on cooking and lighting options being used, sources and average distances travelled to access such sources.
- Cost/price incurred/ paid by consumers to access various types of cooking and lighting options available in target areas.
- Preference and willingness of consumers and potential consumers of cooking and lighting options to pay for improved technologies and services.
- Estimated demand of ICS, biogas and lighting options for households, institutions and other facilities.
- Information on coordination and or potential coordination of the ICS, biogas and solar distribution activities in the target areas.
- Approximate number of micro-businesses in the target areas per 1000 households.
- Existence of micro-businesses already providing electricity based services which do not use grid power.
- Readiness of entrepreneurs and micro enterprises to engage in energy service businesses such as distribution of ICS, construction of ICS and biogas technology, battery and distribution of solar lighting products and services.
- Observation and verification of evidences in the target areas for appropriateness for ICS businesses.
- Description of other organizations/initiatives that are operating within the household clean energy sector in the targeted areas, which are of particular relevance to the project, including main activities, approach taken and lessons learnt from their experience
- Data base of cooking energy actors in the study areas

- Number and impacts of IAP/ hazards resulting from cooking technologies and services in households, enterprises and institutions in the target areas.
- Number of agricultural and rural penetrating companies with their outreach potentials/ numbers and geographical coverage.

## **5. ACTIVITIES**

### **5.1 Project area description**

5.1.1 Mapping of locations where MI have been conducted/ surveyed.

5.1.2 Desk based research on:

- Geographic, socio-economic and demographic context of the targeted regions
- The institutional aspects, legal and administrative framework related to cooking and lighting energy development and which may have influence on the implementation of related projects/ activities in this area
- Environmental urgency (deforestation rate a.o.) to engage with ICS, biogas and other clean energy options.
- Available penetration rate, plans, projects for ICS or biomass cooking services in the target regions in the near future.
- Socio-demographic description of targeted areas, community size, the average income of population
- Assessment of the existing energy infrastructure/services in targeted region/villages on which people rely on; define its main deficiencies; Current level of access to cooking technologies and services (food vending, tea rooms, households, schools, hospitals, kiosks, food roasting, crop curing, heating, crop preservation.
- Assessment of on-going projects/programmes dealing with energy services in the targeted regions, lessons etc.
- Presence of potential local partners to follow up and implement future projects related to ICS, biogas and solar lighting products.
- Available energy options and sources in target regions.
- Assessment of IAP data from relevant institutions and organizations such as District Medical Officers on attributed smoke respiratory infections and deaths from cooking services.

### **5.2 Micro-business survey**

LCBs/ Consultant will select 3 districts in the target regions in collaboration with SNV and carryout the following:

- 5.2.1 Visit the districts and survey them to identify the target information.
- 5.2.2 Estimate the number of micro-enterprises which might be potential providers of energy services and technologies.
- 5.2.3 Identify the approximate number of businesses already providing energy based services and challenges they face. As many existing providers should be interviewed as possible.
- 5.2.4 Assess level of interest amongst entrepreneurs and local implementing partners in providing energy services/technologies and barriers to doing so. At least 10 businesses should be interviewed in each location.
- 5.2.5 Use the observation method to establish cooking technologies and services options and sources available in the target areas.
- 5.2.6 Interviews with existing energy local business and potential local energy businesses should be conducted using a structured questionnaire. Consultant/ LCB will develop the MI tools in collaboration with SNV advisors.

- 5.2.7 Meeting with community leaders – a meeting should be held with local community leaders to discuss energy needs and their views on cooking energy products/services (discussion topics will be written).
- 5.2.8 Community Interviews – Interviews will be conducted with various local NGO, and CBO and financial institutes. Interview guide will be written for information required.
- 5.2.9 Number and impacts of reported and unreported IAP incidences

### **5.3 Consumer demand Survey**

In order to estimate the demand forecasts for the project, the LCB/Consultant undertake consumer demand survey.

- 5.3.1 Approximately 40 consumers will be interviewed (that should include a mix of household, institutions and of local traders that could benefit from improved cooking and lighting energy services such as street food vendors, “NyamaChoma” roasters, Chips Kiosks, restaurants etc.).
- 5.3.2 Interviews with households, institutions and local traders should be conducted using a questionnaire. LCB/Consultant will develop the questionnaire in collaboration with SNV.
- 5.3.3 A preference of consumers will be explored in terms of cooking technologies/services desired.

### **5.4 Enabling Environment Survey:**

The LCB/ consultant will directly interview actors and stakeholders in the enabling environment as per the guidance of the data collection tools developed. These include:

- Local Government Authority: inclusive of, but not limited to, relevant departments in agriculture, planning, Community development and environmental unit. The LGA will convene these LGA department staff jointly in a session that is to last no more than 2 hours.
- Civil Society: The LCB/Consultant will directly interview local NGOs, FBOs and parastatal with guidance from the MI field tool. The intent of these interviews will be to gain deeper understanding of challenges and successes in past, present and future clean cooking and lighting programs ongoing in the district.
- Finance: The LCB/ consultant will engage with local micro-finance institutions (SACCOS, etc.) as per the guidance of the data collection tool developed. The intent of the interviews will not be to establish lending mechanisms, but rather to identify potential MFIs who would deem ICS (or RE in general) as worthy of consumer or enterprise credit provision.

### **5.5 Supply Chain survey/ assessment**

The LCB/consultant will directly interview and assess ICS, biogas and solar lighting supply chains (actors) in the target regions. The survey is aimed at identifying existence of developers/ suppliers/ distributors/ transporters of ICS, biogas and solar PV technologies and services available in the target regions. It will also provide information on challenges, opportunities and preferences for an improved scenario. Findings should include number of manufacturers, importers, suppliers, distributors, transporters, retailers and after sale service providers of cooking and lighting technologies in target regions.

### **5.6 Agricultural and rural penetrating companies with extensive outreach (number) beneficiaries assessment**

LCB/ Consultant shall assess existence of agricultural companies, livestock networks, and other rural penetrating companies with extensive networks and explore possibilities of becoming distributors of ICS and solar products.

## 5.7 Energy options analysis

The LCB/ Consultant should compare various alternative energy cooking solutions/options available in target regions to establish individual technologies life cycle costs analysis of available options and cost benefit analysis. Where possible, the LCB/consultant shall purchase sample products of different ICS encountered in the field during MI surveys.

## 6. Scope and Duration of the assignment

The scope of this Market Intelligence assignment is defined as follows;

- Baseline survey regions will be conducted three regions by separate LCDs/ consultants to ensure timely deliverables. The regions will include Mtwara, Arusha, Iringa, and Tanga regions.
- Mapping and description of the target regions in collaboration with the ICS Task force
- Data collection, compilation, analysis and reporting
- Validation and verification of MI findings in collaboration with ICS taskforce
- The Assignment shall be undertaken for approximately 60 days from 15<sup>th</sup> May – 15<sup>th</sup> July 2013 as follows:
  - 1<sup>st</sup> July – 8<sup>th</sup> July 2013: Inception report
  - 9<sup>th</sup> – 17<sup>th</sup> July 2013: Data collection tools development and approval in collaboration with SNV and ICS task force
  - 18<sup>th</sup> July – 23<sup>rd</sup> July 2013 – literature collection and review for secondary data collection.
  - 24<sup>th</sup> July -23<sup>rd</sup> August 2013 – site visits, surveys, consultations, interviews, etc.
  - 24<sup>th</sup> -28<sup>th</sup> August 2013: Draft report
    - 29<sup>th</sup> August -4<sup>th</sup> September 2013: consultation workshop/ commenting and inputting/ data validation and verification
    - 12<sup>th</sup> September 2013: final draft

## ANNEX 2: LIST OF CONTACTED PERSONS

### ARUSHA REGION

DISTRICT	WARD	VILLAGE	NAME	PHONE		
ARUMERU	NGARENANYUKI	KISIMIRI	ELIBARIKI-JOSHUA-NNKO	0762-081173		
			MALAKI M-NASARI	0758-938547		
			BERTA TAZAMAEL	0766-650743		
			ELBARICK JOSHUA	762081173		
			DANIEL S MBISE	0756-778628		
			FLORA GODWIN	0757-984944		
			AKUNDANIS WA-EMMANUEL	0759-034932		
			ONESMO NASSARY	0763159458		
			SIFAEEL TIMOTHEO	N/A		
			OMBENI CHRISTOPHER NASSARY	N/A		
		ISACK ANAEL NASSARY	0765425702			
		KABANAEL URIO	0757840373			
				OLKUNGWADO	ELISANTE MOSE	768589372
					JOYCE ELIA	
					NDEKIRWA ABRAHAM	755870771
					JESSICA ISAAC	
					ELIAS MBISE	763569143
					JOSHUA LUBANGO	0752 466104
					TUMAINI MATEY	758439565
				SAMSONI	0768 120854	
				ELINASHA ELIREHEMA		
				ELISHOISA	0765 898898	
				GIFT MEENA	752953782	
				AMINI NAFTAL	752930390	
		USA	MJIMWEMA	REDEMPTA MASSAWE	754090215	
				NEEMA LAZARO	763643771	
				GABRIEL MARTIN	764160818	
				PAULINA MALAKI MOLELI		
	FREDERICK MSUYA			784358068		

		ANEMA-JACOB MUSHI	768900054
		MARY PETER	759315002
		HILARY LOSMAS	784392901
		WINNIE MMBABA	764908681
		EMMY KESSY	757694647
		GUNISHA JACKSON	763297933
		JURGEN MALHISA	755024820
		ZAWADI MIRAMBO	752248788
		AMINA SHARIFU	754534757
	MAGADINI	AMINA AMIS	719417825
		ANNA PROSPER	762352781
		EMMANUEL JAMES NGOIVA	0763068108
		FASIA HAMISSI	759738212
		FELIX URIO	763766386
		HAIKA ELIAS MASHOO	0768514401
		JOEL JAMES NGOIVA	0753361021
		JUDICA S KILawe	
		LUCY LYIMO	0785342415
		LUKIA DANIEL	0759253601
		MAFILDA EMMANUEL	764204977
		MAGRETH SARA KIKYA	0755303399
		MAMA NAMAYAN	0756672010
		REBECA	787211284
		RITHA DAVID	752645162
		TUNU RAMADHANI	768945892
		VERIAN MUSHI	0782690715
		WAYATUMI SWAI	683018408
		ZAINAB MOHAMMED	765057605
	MAGADIRISHO	REHEMA KEPHAS	789721808
		BEATRICE DEO MUSHI	756527583
		STELLA M MASSY	763847488
		TADBI-SIMBA-MALYA	0759-152054
		ANNA MUMBER	
		RAEL MPINGA	0765-349479
		TINA TOSHA	0782-054350
		DOREAS YOHAN	0786-294258
		JUMA HUSEN	0756-202430

		NOEL LEMA	
		CHRISTOPHER MANJEKA	0765 954268
		NSAK HOSENI	
		JOHN SHAURI	0755074294
		DONART MARMO	0756854404
OLDONYOSAMBU	LEMON'GO	ESUVAT JACKSON	
		ANGEL PAULO	
		SAMWELI MURIATOI	0753-516822
		HELEN JOSEPH MORIATOI	0753-203926
		MZEE MASENBE MWARINGO	
		MARIA DANIEL MBISE	0753-672202
		MARY DANIEL MDEL	0759-492123
		EASTER SAUIDO	766429628
		SION JOEL	752641257
		YUILLISOA KIVUYO	
		BAHATI SHEBRACK	767326889
		LILIAN YUSUFU	768580105
		AGATHA CHRISTOPHER	754872181
		VICKY EZEKIEL	762782323
		STELLA JOSEPH	754919152
	OLDONYOWAS	ANNA LOTHY	766653431
		APAKUNDA JULIUS SINDIO	
		CHRISTIAN KIMARO	
		IRENE AND REX	767571226
		JACCKSON LAIZER	0759562199
		JANE SAMWEL ROBERT	0755512908
		LEAH PETRO	768210259
		MARY SAMUEL MEIBUKU	0766-658896
		REBECA LOUREI 0762176597	
		REUBEN MEMILIEKI 0759628546	
		UNAMBWE LAINEY	0785245315
		UPENDO KIVUYO LENIN	759267938
	LOSINONI	SAIBOK SARBABI	765477964
		ESUVAT LOMNYAK	764055516



			ELIZABETH LOISHIYE	753649989
			JOEL LAIZER	
			PAULINA ALFA	769499659
			BIBI NASIOE	684798809
			SAIGURAN LAIZER	
			EDUARD LAIZER	752094928
			PETER MOLEL	785795694
Longido	ENGARENAIBOR	MAIROWA	ANNA JOSEPH	
			ELIAS LUKUMAY	786792005
			HALIMA SAID	
			JUDITH FRANK	688286490
			JUMA LAURENT	685067796
			MAGE GEORGE	787426620
			MAMA TUMA	787490362
			MARY KITUMO	686924462
			MARY PETER	688287915
			MARY WILLIAM	
			NAMNYAKI RETETI	0684688382
			NANGEPA NASAMUS	698008234
			NDININI SUMUNI MOLLEL	0784561297
			NOSIM SABORE	786105369
			ONESMO LAIZER	0787503902
			RUKIA ALY	
			SINON STEVEN	782649854
			SOPHIA NANYARO	783293502
		SINONIKI	NGAYA SAMWEYA ZAMRUYA	
			KASHERUGO LEKAPEE	
			NOSEC LESANE	
			MARIA KIPARA	
			MAMA NGARA	
			NGAISI NGAIYO	
			ALATATI LESANE	
			PHILLIPO	786504971
			NAISGAWI SAIKOTI	
			LASOI NINA	
			GRACE NGAYA	
			KALANTI KAPEI	
			NASHA NGARSAI	

		NAGARI NAISANGU MOLLEL	
		NALOHO PHILIPO	
		NDOLEI LASANE MOLLEL	
	NGOSWAKI	RAHEL BAHNUKI	
		SAYORO LONYUMBU	
		KASHUMA KIMATE MOLLEL	0683-162509
		NOAH KIMWELI	
		NORIKISHONI TOTII	683162509
		NATEMTA TULITO	
		NONBUMUNI LIKUSHA	
		MOSES MUYA	
		NAPANU KIPAPA	
		NAROSIM NETITI	686771578
		NASINARI KAPEI	
		NORIK NYKU	
	LONGIDO	RANCH	MARGET KIEMBA
		NAONANALISHO PHILIPO	
		NASARO	
		NOONGISHU	
		NOISKITO PHILIPO	
		NALIRUNDAGWA KIMANI (NO PHONE)	
		NEEMA NAROWA	
		NASKARI KALANGA	
		NARUMET NANGARI	
		SOMBET LAEKIPA	
		KAERE LAEKIPA	
		SAMATO LAKIPA	
	ALTEPES	NGANANA MAITIRE	
		SENDUI MAITIRE	
		YEYAI SALUA	
		ISAYA LORUKUYO	
		JACKSON SEREMON	0782-851965
		NAANGAGWA LEMEIEMI	(NO PHONE)
		SARUNI MENGORU	783794555

			MARY KOLONIA	786357912
			KORDAN MAIOER	
			RAHELI PHILIPO	0784 827381
			ORKIMBOGOTO NAITISHINE	
			SARAWA LEMAS LAIZER	
			MERIKINOI LEMEREMI	

**MANYARA REGION**

DISTRICT	WARD	VILLAGE	NAME	PHONE
BABATI		KOMOTO	CATHERINE AMOSI	0688 045411
			CHRISTINA ATANAS	0767483965
			CHRISTINA IBRAHIM	0688903034
			DOROTHEA PETER	0766560992
			ELIZABETH NIKOLAS	0688025082
			FEBRONIA PETER	0683 611110
			HADIJA SELEMANI	0785033770
			JOSEPHAT ZAKARIA	0786947694
			KHADIJA KHALIFA	0713977029
			LIGHTNESS	
			MAMA GABRIEL	
			MAMA NICKSON	0754392332
			MARIA JULIUS	
			MARTINA PASIAN	
			NEEMA PETRO	0754788084
			PAOLINA NYOMI	
			PHILIPO JOHN	0689247451
			RAMADHANI HANGALI	0769 073273
			REGINA MEHETU	
			SELINA MATHIAS	0688170220
			STELLA YUSTIN	
			TIATA WELO	0754 899071
			URUSULINE GABRIEL	
			VERONICA BEATUS	
			VERONICA SIHA	
			VICTORIA GABRIEL SONGAY	0682853451
		YUSTINA GWANGWA	0788778162	

	NAKWA	RODA WEMA	0786813460
		LUCIA PAULO	
		MERCELIN JOHN	0764530544
		HADJIA RAJAB	
		FATUMA HAMY	
		ANNA YOHANA	
		MWANTUM OMANY	
		MONIEA IZRAELI	
		MAMA MAKUNDI	
		REGINA HUSEN	0784-601756
		CELINA HEKI	
		CHRISTINA JOHN	0784-624615
		CHRISTINA SHABANI	0688-532568
		NEEMA GIBOLI	0683-180373
		CELINA OYE	0689-796018
		ESTER LINUS	0684-730729
		LEONIA CHUWA	
		MARIA NADA SINDANO	0688453396
		SELINA MICHAEL	0786778442
		JOVITHA BALANG	NIL
		MARTHA JOSEPH	0787878862
	OSTERBAY	CATHEREEN DAGHARO	0782-761680
		MAMA JACQUELINE	0787-240273
		ANNA JOSEPH	0767-885069
		RACHEL SOHN	0786-658922
		ASMINI HASAN	0784-508560
		ADIA ALLY	0759-867625
		DESDERIA DENIS	0685-934044
		LIDIA KIPALAZI	0757300214
		FRANSICSA PAULO	0686316066
		ASMIR HUSSEN	
		GODWIN MMARY	
		BEATRICE SIMON	0784139599
MUTUKA	MUTUKA	ADAM JUMA	0753382785
		ALEX NADA	078746005
		BURA QMBAALALI	0687 8050 60

		HASSAN LOHAY	0757111102
		NEEMA KOYI	
		PETRO HILDA	
		RAHABIA ALI	
		SAUDA ALI	0754 293024
		UPENDO MESIAKI	
		WAZIRI ABASI	078746005
		ANASTASIA ALI	
		ASHA HUSEIN	
		MWAJUMA RAMADHANI	
		ZAUDA OMARY	0758748201
		FATUMA SAFARI	
		ZAITUNI ABIDI	0768 546928
		AMINA MOHAMED	0764658751
		REHEMA IDDI	0766 069636
	CHEMCHEM	ABDALAH SALIM	0786892911
		BAHA LOYE	
		HANGALI HITI	
		MARIA BAHA	0789650044
		MARIA MEROULA	0762936799
		MATHIAS GSOINE	0783851177
		MONIKA DANIEL,	
		NEEMA ADAM	0782827457
		NEMA ESTON	
		RUTI LENAROCK	0688532613/ 0785460964
		SAIGURA MELITA	
		SELINA ELISHA	
		THIMOT STONE	0788969279
		TWAHIRU.RAJABU.MBAGA	0689456889
		LAITETE SITON	
		SIMON MOLEL	
		DANIEL MAO	0752 526342
		ABASI RAMADHANI	0784 931687
		KATARINA JOSEPH	0787080117
		ELENA KILEMBO	
		PAULINA MATHAYO	0785911341

HANANG	GENDABI	DAWARI	SAMWEL MALISHA	0785 462233	
			MARCO MABHE		
			MWL JOHN	0782594992	
			MAKANIA MOLLES	075759560	
			CAROLINA EXAUD		
			MAMA TORO	78529275237	
			SAMUEL RAPHAEL	0757103490	
			EMANUEL	0789337819	
			FRIBA KAAYA	0787-090179	
			KATRINA ANDREW	0789 337787	
			ANNA ALI	0688697674	
			ADAM MUNGOYA	0785281545	
			JUMA GAU	0784220255	
			NYANGURA MASABI	0782737077	
			QAMBADIYAY LONGU	0787076950	
			FLORA PATRICK		
			CATHERINE NIKODEMUS	0683122034	
		GENDABI		DANIEL NANGAI	786073885
				CHRISTINA MBASILE	786200712
				FELISTA MARTIN	783851903
				TUMAIN BENJAMIN	683972393
				PHILIPO MAYO	
				SIFAELI.M.NJOKA	784500992
				MONICA MATHAYO	685437156
				ANGEL STEVEN	
				JULI MASA	687010946
				NICOLAUS	789227110
				MAMA NIKO	787089204
				OLIVIA PHILIPO	783851405
				MARTA MATTA	789533985
				ADAM PAULO	788037846
				ELIAS JUMA LOHONIEL	
				MICHAEL BENJAMINE	7840780331
			AMANI LUCAS	0686-093307	
			SABINA ORESTI	0688-261072	
			DOREEN DAMIANI	0783-831834	
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		FABIOLA YAE	
		MML NJEMA	688453613
		REBECCA PATRICIA	
		MAGORET AMI	787521660
		ANDREA LOHAY GWANDU	0787960931
		CECILIA ERASTO JOSEPH	0782768217
		JUMA BOKI	0782 962415
		CELINA JOSEPH	0685 472783
		PASCALINA ZAKARIA	
		JUMA HONDI	0787 272857
ENDASAKI	ENDASAKI	SCOLA WILLIAM	0684 839991
		MELANIE BAKARI	783340494
		HAFSA ALLI MOHAMAD	787500117
		LUCY PANGA	789477707
		HERMAN JOROJIK	784793253
		IDDI BAKADRI NINGA	
		PETER JOHN	759698633
		PHILLIPO AXWESO	787303968
		RAMADAN HOUSSEIN	787187332
		VASCOTT ERNERST MURRO	0753/0787- 510850
		PETER ISARA	0765734601
		AMINA GWANDU	0784437002
		ABUBAKARI DAHARO	0683724080
		REBECA MBISE	0763637355
		ANNA ANDREW	786305022
		HAJI SONGORE	0685372767
		JUMA RASHID	0787685100
		MARCO MAKAP	0784669246
	ENDAGAW	AMINA ALLY	0688261765
		HAWA SAIDI	0786813903
		MOHAMED ATHUMAN	
		ELIA AMA	0782510178
		HAZINA KARANJAI	0756285818
		JUMANNE H. WAWA	0782760853
		GRORGE IBRAHIM	0688899346
		AMAS RAMADHAN	0784195445

		CELINA GARE	0785761582
		BAKARI HAMIS	0687575050
		JOSEPH FOCUS	0786813501
		ISMAELI KIWALI	0787974726
		MWAJUMA SAIDI	0788-309895
		ISRAEL JACOB	0682 090757
		HAJI OMARI	0782 202198
		HUSEIN WAZIRI	068292 0837
		RAMADHANI HAMISI	0782 202155
		TOMAS ISSA	0783 843704
		MWANAHAMISI SALIM	0688261654



# ANNEX 3: INSTRUMENTS USED FOR THE SURVEY

## QUESTIONNAIRE SNV/KAKUTE MARKET INTELLIGENCE.

### Market analysis and development for ICS products for commercial market in Arusha

Collect information on each subsector in relation to the selection criteria mentioned in TOR. This information will be both quantitative and qualitative in nature. While secondary studies can be consulted, this information should be based primarily on direct research with key informants from the subsector (key informants can be defined as any person with a broad understanding and knowledge of all aspects of the targeted subsector. They can include representatives from lead firms, consultants with specialization in the value chain, association officials, etc.)

### LEADING QUESTIONNAIRE FOR EACH STAKEHOLDER IN THE VALUE CHAIN.

#### 1. QUESTIONNAIRE FOR: GOVERNMENT INSTITUTIONS.

- 1) The population in the area
- 2) Major economic activities in the area
- 3) Major challenges faced by the government leaders related to energy,
- 4) What type of cook stove main used for household and institutions in your area?
- 5) What type of fuel is used for cooking at households and institutions?
- 6) How much is the demand per month/per year in an average?
- 7) What is the major source for your products?
- 8) Who are the major suppliers of fuel for households in this area?  
*To question 5,6 & 8 more explanation was requested*
- 9) Are you aware of RETs and especially ICS to protect environment, IAP and reduce poverty?
- 10) Do you have a policy and strategy that address, recognize and support RETs in your region/district/village?
  - a. If not: Would you support the program if initiated?
  - b. If yes: Where do you see your role?
- 11) How many wholesalers are in this area? And where are they located?
- 12) Are your extension services and network deals with issue related to RETs?

#### 2. QUESTIONNAIRE FOR: HOUSE HOLD

1. Size of the family at the house hold: \_\_\_\_\_ Elders \_\_\_\_\_ children \_\_\_\_\_
2. Profession of the head of the house \_\_\_\_\_
3. Average income per day \_\_\_\_\_/month \_\_\_\_\_
4. Major expenditures per day \_\_\_\_\_/month \_\_\_\_\_
5. Average saving per moth \_\_\_\_\_
6. The types of cookstoves used at the households \_\_\_\_\_ what price for each \_\_\_\_\_
7. Why choosing this cook stove/fuel? \_\_\_\_\_
8. Where did you buy this stove \_\_\_\_\_
9. Do you know by any chance who is the supplier? \_\_\_\_\_

10. What kind of fuel used for cooking and price(per unit)

\_\_\_\_\_

b) For lighting what kind and price (per unit)

11. How often do you use your cooking stove per day \_\_\_\_\_, and for how long(daily average) \_\_\_\_\_

12. Average expenditure for fuel per day \_\_\_\_\_/ month \_\_\_\_\_

13. Where is the cooking place? Inside \_\_\_\_ or outside\_\_.

14. What are the challenges faced when using this technology? \_\_\_\_\_

15. Are you aware of RETs(Biogas, LPG, Solar Home Systems, Solar Laterns) / ICS (Briquette, Pilate) and its use to reduce IAP and reduce cost?

16. Do you use RETs or ICS and if yes which?

a. If yes:

i. Why did you buy these products?

ii. Where did you buy the product(s)? How much did you pay for it?

iii. How often do you buy these products?

iv. Are you satisfied with it?

v. What limits you from buying other products?

b. If no:

i. What limits you for not using those RETs? Not aware, price, usability or availability?

ii. What are proposed solutions?

17. Would you wait to see any changes or improvements?

18. Who normally buy these products?

### 3. QUESTIONNAIRE FOR INSTITUTIONS

1. Name of institution \_\_\_\_\_

2. The number of the people in the institution \_\_\_\_\_

3. Number of people that is cooked for \_\_\_\_\_ Male \_\_\_\_\_ female \_\_\_\_\_

4. Type, size and fuel of cook stove used for cooking \_\_\_\_\_

5. Type of technology used for electric energy \_\_\_\_\_

6. Why did you choose this technology? \_\_\_\_\_

7. Where did you buy this product? How much did you pay for it?

8. How often do you buy these products?

9. Are you satisfied with it?

10. Average cost for each per day \_\_\_\_\_ /month \_\_\_\_\_

11. How often and for how long do you use your cooking stove?

12. Are you aware of RET's available in the market?( ICS, Briquette, SHS)

13. What limit you to change? Awareness, price, usability or availability.

14. What is your proposed solution to change? \_\_\_\_\_

15. Who normally buy these products?

16. What limits you from buying other products

17. Would you wait to see any changes or improvements?

18. Why did you buy these products?

### 4. QUESTIONNAIRE FOR: SMEs

#### Retailer shop:

1) Are you aware of RETs/ICS technology and its advantage?

2) Do you sale RETs technology? If not explain why!

If Yes: (further Questions should specify on the RETs sector of SME)

a. What is the average margin you make from your RET products?

- b. Where do you get your RET products from and for how much?
  - c. How do you access your market? How much do you selling per year an average?
  - d. To whom are you selling to? What is the best price you can sale? How much are they able to pay? How much are they will to pay?
  - e. If other RETs product is available would you be interested to buy and sell in your market?
  - f. What do you think is hindering your market volume?
  - g. What do you think need to be done to improve the supply and the market?
- 3) How many organizations and company that are dealing with RETs in this area?
  - 4) How many development projects related to renewable energy is implemented in your area.

## **5. MANUFACTURER (PRODUCER)**

- 1) What is your main product related to RETs and ICS?
- 2) What other products do you produce/sell?  
*Further Questions should only ask for the RETs/ICS sector*
- 3) What does each product represent in terms of your gross revenue (percentage and total amount in TSH)?
- 4) What have you done recently to improve your products or services?
- 5) Is your current equipment or machinery an impediment to growth?
- 6) Explain. If so, what kind of equipment or machinery could improve your business?
- 7) Is the current level of your workers training holding back growth? If so, what additional training do they need?
- 8) How much do you produce per month in amount?
- 9) Is this the maximum production capacity?
- 10) How much are your products cost? Is your price comparative?
- 11) Do you sell retail or through wholesaler and distributers?
- 12) Who is your major customer? And why
- 13) How do you monitor your product to the end user?
- 14) What do you think is the major constraints to achieve your goal?
- 15) What need to be done to improve your production supply and increase your market?

## **6. FINANCIAL INSTITUTIONS (MFI SACCOS ROSCAS)**

- 1) Have you heard about the business opportunity in energy for financial institutions?
- 2) What are the financial options in energy that you have?
- 3) Have you had any developed financial products for RETs sector? What are they?
- 4) Do you have any market strategy for energy portfolio?
- 5) What type of risk management you undertake for energy portfolio?